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Canada

2018

Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

Figures and Tables

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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Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) 2018

Figures and Tables

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Provincial public health laboratories

We gratefully acknowledge the provincial public health laboratories for their longstanding support and for providing data and bacterial isolates for CIPARS:

- British Columbia Public Health Microbiology and Reference Laboratory, Provincial Health Services Authority, British Columbia (Linda Hoang)
- Provincial Laboratory for Public Health, Alberta (Marie Louie)
- Saskatchewan Laboratory and Disease Control Services (Greg Horsman)
- Cadham Provincial Laboratory, Manitoba (John Wylie)
- Public Health Ontario Laboratory, Public Health Ontario (Vanessa Allen)
- Laboratoire de santé publique du Québec de l'Institut national de santé publique du Québec (Sadjia Bekal)
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- Microbiology Laboratory, Queen Elizabeth II Health Sciences Centre, Nova Scotia (David Haldane)
- Laboratory Services, Queen Elizabeth Hospital, Prince Edward Island (Greg German)
- Newfoundland Public Health Laboratory (George Zahariadis)

Retail meat surveillance

We would like to extend our thanks to the following organizations for their participation in CIPARS Retail Meat Surveillance:

- Centre for Coastal Health (Carl Ribble and Stefan Iwasawa)
- Agriculture and Agri-Food Canada (Mueen Aslam, Tineke Jones, Cara Service, and Tim McAllister)

We also thank the following health unit managers, public health inspectors, and environmental health officers: Bob Bell, Tanya Musgrave, Torsten Schulz, and Lee Siewerda.

Abattoir surveillance

We would like to thank the abattoir operators and the Canadian Food Inspection Agency's regional directors, inspection managers, and on-site staff, for their extensive voluntary participation in CIPARS Abattoir Surveillance.

Farm surveillance

We are grateful for the support of the Canadian Poultry Research Council, the Ontario Ministry of Agriculture, Food and Rural Affairs, and the Saskatchewan Ministry of Agriculture, as well as the sentinel veterinarians and the producers who participated in Farm Surveillance by providing data and enabling collection of samples for bacterial culture.

We would like to acknowledge the following organizations for their contribution to the CIPARS Farm Surveillance components:

- Alberta Chicken Producers
- British Columbia Chicken Marketing Board
- British Columbia Turkey Farmers
- Canadian Hatcheries Federation
- Canadian Pork Council and Provincial Pork Boards
- Canadian Poultry and Egg Processors Council
- Chicken Farmers of Canada
- Chicken Farmers of Ontario
- CIPARS Farm Broiler Chicken Industry Antimicrobial Use/Resistance Working Group
- CIPARS Farm Swine Advisory Committees
- Les Éleveurs de volailles du Québec
- Turkey Farmers of Ontario
- Turkey Farmers of Canada

Provincial animal health laboratories

We gratefully acknowledge the provincial animal health laboratories for their longstanding support and for providing data and bacterial isolates for CIPARS:

- Animal Health Centre, British Columbia Ministry of Agriculture (Erin Zabek)
- Prairie Diagnostic Services, Saskatoon (Kathy Dielschneider and Musangu Ngeleka)
- Veterinary Services Branch Laboratory, Manitoba (Neil Pople)
- The Animal Health Laboratory, University of Guelph, Ontario (Durda Slavic)
- IDEXX Laboratories, Ontario (Hani Dick)
- Laboratoire d'épidémiosurveillance animale du Québec (Julie-Helene Fairbrother)
- Provincial Veterinary Laboratory, Department of Agriculture, Fisheries, and Aquaculture, New Brunswick (Jim Goltz)
- Veterinary Pathology Laboratory, Nova Scotia (Catherine Graham)
- Diagnostic Services, Atlantic Veterinary College, Prince Edward Island (Jan Giles)
- Animal Health Laboratory, Department of Fisheries, Forestry and Agrifoods, Newfoundland and Labrador (Laura Rogers)
- Department of Fisheries and Agriculture (Jeannie Tucker)

Quantities of antimicrobials distributed for sale for use in animals

We would like to sincerely thank the Canadian Animal Health Institute (CAHI), its President Jean Szkotnicki and their member companies for voluntarily providing the quantities of antimicrobials distributed for sale for use in animals in Canada. We would also like to thank Impact Vet for collating the data.

CIPARS would also like to thank Stephanie Brault for her recent input to appropriate weights for the Canadian denominator.

CIPARS thanks the European Surveillance for Veterinary Antimicrobial Consumption, the Food and Drug Administration's Center for Veterinary Medicine of the United States, and the World Organization for Animal Health (OIE) for many long discussions on appropriate denominators for antimicrobial sales/distribution data.

CIPARS would also like to thank Fisheries and Oceans Canada (Ed Porter and John Martell) for providing interpretation and context to the data collected by Fisheries and Oceans Canada for marine finfish and landbased and freshwater fish data.

Other participants

We gratefully acknowledge the efforts of field workers, laboratory technicians, and data managers for their contributions. The careful collection of samples, processing of isolates, and recording of results are essential to the ongoing success of CIPARS.

We are grateful to the National Antimicrobial Resistance Monitoring System of the United States for sharing information and facilitating harmonization with CIPARS.

We would also like to thank the following individuals and organizations for their contribution to CIPARS in 2018:

Public Health Agency of Canada

Ashleigh Andrysiak, Louise Bellai, Mark Blenkinsop, Matthew Cook, Sindy Cleary, Ann-Marie Cochrane, Nina Dougherty, Marie-Claude Deshaies, George Golding, Dolly Kambo, Nicol Janecko, Suzanne Johnson, Stefanie Kadykalo, Jasmina Kircanski, Ora Kendall, Lisa Landry, Stacie Langner, Julie Légaré, Sarah Martz, Ryan McKarron, Ketna Mistry, Ali Moterassed, Manuel Navas, Linda Nedd-Gbedemah, Derek Ozunk, Frank Pollari, Julie Roy, Sophia Sheriff, Jayson Shurgold, Glenis Smith, Lien Mi Tien, Myrthi Viswanathan, Rama Viswanathan, Victoria Weaver, Betty Wilkie, and Irene Yong.

We are grateful for the support for antimicrobial use metrics development: Angelina Bosman, Daleen Loest, and Lucie Collineau.

Canadian Food Inspection Agency

Daniel Leclair, Debbie Roffe, and Marina Steele

Health Canada, Veterinary Drugs Directorate

Xian-Zhi Li and Manisha Mehrotra

Health Canada, Pest Management Regulatory Agency

Brian Belliveau

Canadian Meat Council

Independent contractors

John Ranson and Ron Templeman

What's new for CIPARS in 2018

At the Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS), we are modernizing how we share our information with different audiences. We are currently transitioning to our new communication tools and formats for the 2019 data. In the meantime, CIPARS will continue to deliver the same information, but in a modified manner. For the 2018 data, we will be releasing 4 documents: 2018 Executive summary; 2018 Figures and Tables, which includes the traditional summarized information but little accompanying text; 2018 Design and Methods; and 2018 Integrated Findings.

Antimicrobial use in animals

- Data collected under legislation by Health Canada from veterinary pharmaceutical manufacturers, importers, and compounders for 2018 is currently being analyzed. Results will be released as a separate report in Spring of 2020.
- In 2018, grower-finisher pig quantitative antimicrobial use metrics were reported for the first time for antimicrobial use in water and injectables.
- As of 2018, the antimicrobial use metric nDDDvet/PCU was no longer be reported.

Antimicrobial resistance

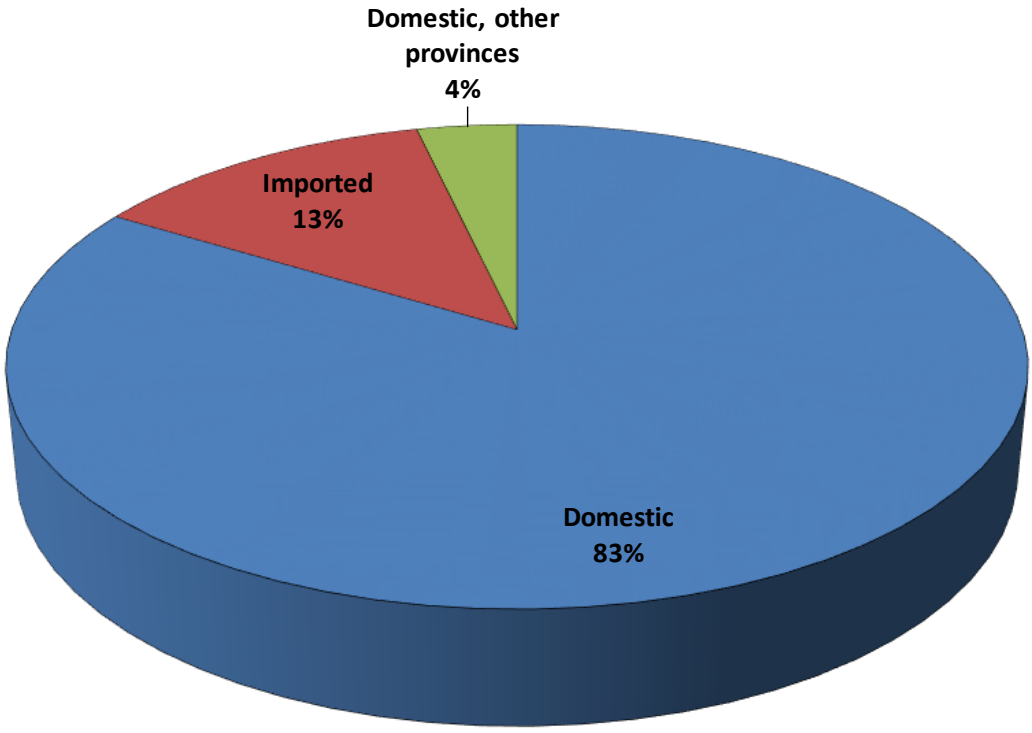
- There was no placement broiler chicken sampling conducted in 2018.
- For farm surveillance, sampling in turkeys was initiated in Alberta.
- Only a partial year of retail sampling was conducted in Ontario and the Prairies, and no sampling occurred in the Atlantic region; therefore no temporal retail data from these regions are presented in 2018.

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

Chapter 1 Animal health status and farm information

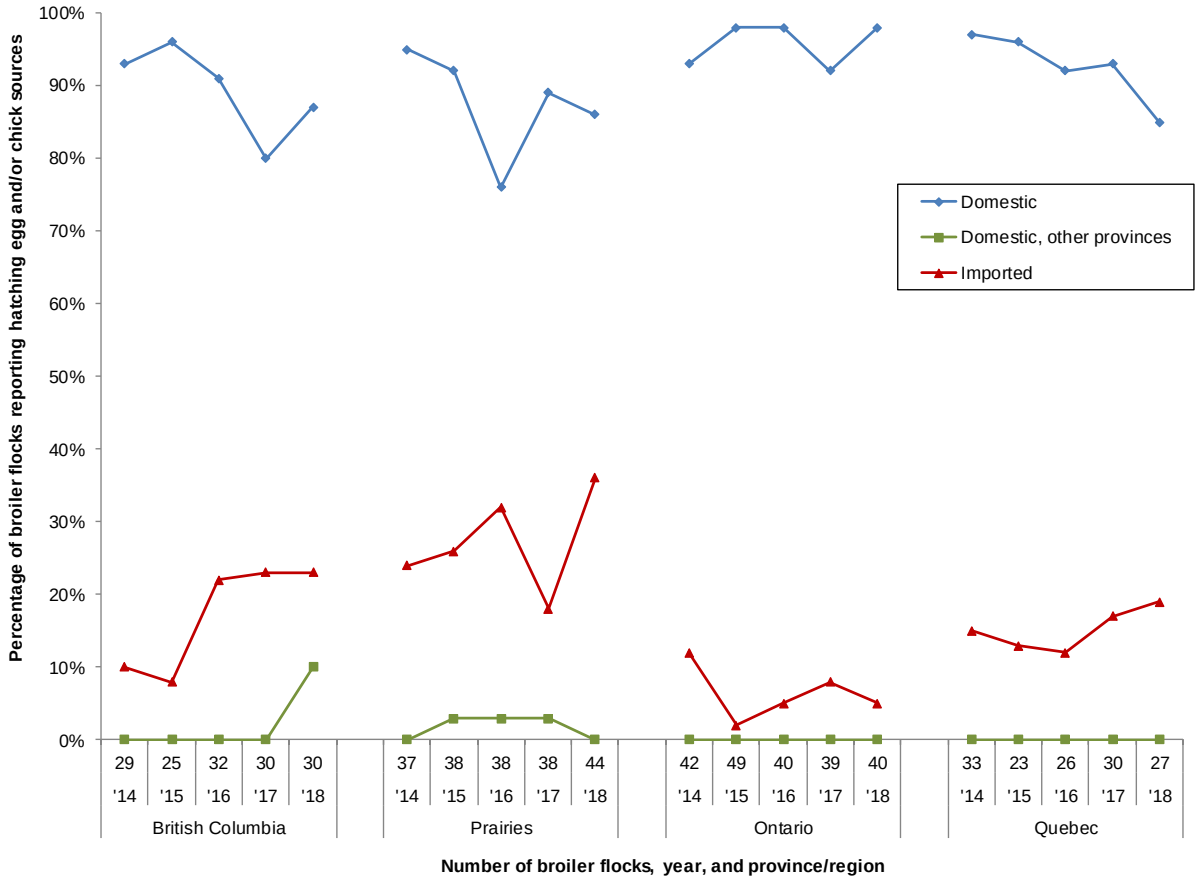
Broiler chickens

Figure 1. 1 Relative distribution of chick sources, 2018



Domestic = hatched within the province where the birds were raised.
Domestic, other provinces = hatched in a different province from where the birds were raised.
Imported = hatching eggs and/or chicks were sourced by the importing hatchery from the United States or other countries.

Figure 1. 2 Sources of hatching eggs and/or chicks placed in the barn sampled by province/region, 2014 to 2018



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks	29	25	32	30	29	37	38	38	38	45	42	49	40	39	40	33	23	26	30	27
Hatching egg and/or chick sources																				
Domestic	93%	96%	91%	80%	86%	95%	92%	76%	89%	87%	93%	98%	98%	92%	98%	97%	96%	92%	93%	85%
Domestic, other provinces	0%	0%	0%	0%	10%	0%	3%	3%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Imported	10%	8%	22%	23%	24%	24%	26%	32%	18%	36%	12%	2%	5%	8%	5%	15%	13%	12%	17%	19%

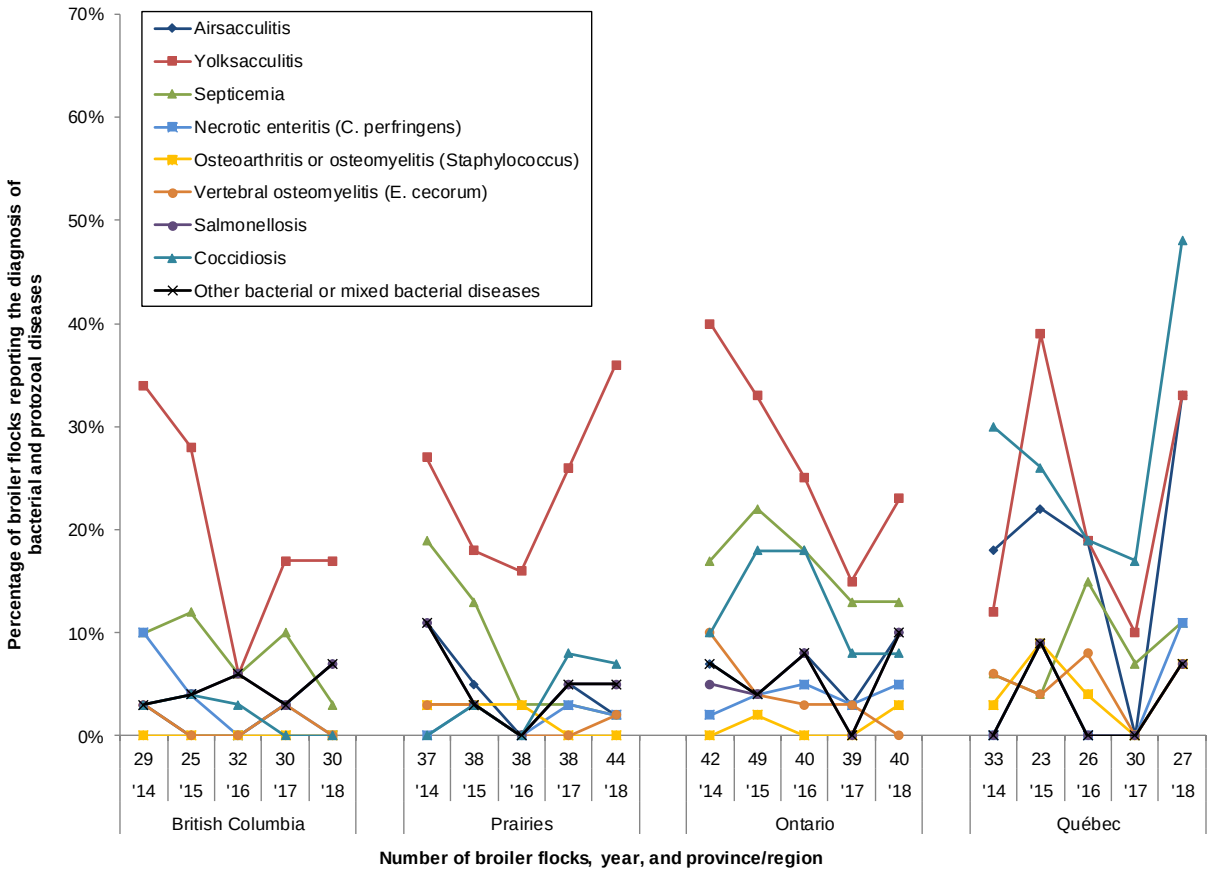
Domestic = hatched from hatcheries located in the province where the birds were raised.

Domestic, other provinces = hatched from hatcheries located in provinces other than the province where the birds were raised.

Imported = hatching eggs and/or chicks were sourced by importing hatchery from the United States or other countries.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 1. 3 Percentage of broiler flocks reporting bacterial and protozoal diseases by province/region, 2014 to 2018



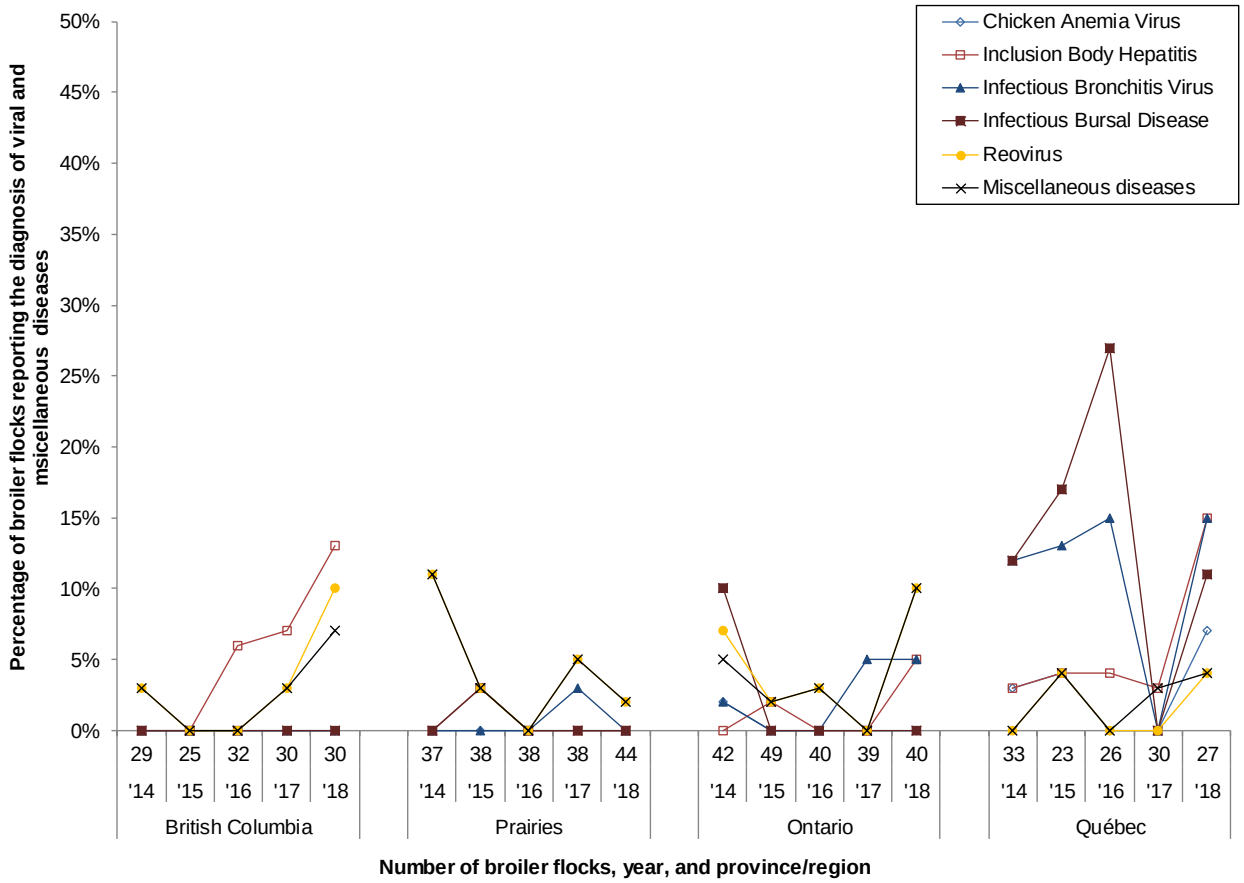
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks	29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Diseases																				
Airsacculitis	3%	0%	0%	3%	7%	11%	5%	0%	5%	2%	7%	4%	8%	3%	10%	18%	22%	19%	0%	33%
Yolksacculitis	34%	28%	6%	17%	17%	27%	18%	16%	26%	36%	40%	33%	25%	15%	23%	12%	39%	19%	10%	33%
Septicemia	10%	12%	6%	10%	3%	19%	13%	3%	3%	2%	17%	22%	18%	13%	13%	6%	4%	15%	7%	11%
Necrotic enteritis (*C. perfringens*)	10%	4%	0%	3%	0%	0%	3%	0%	3%	2%	2%	4%	5%	3%	5%	0%	9%	0%	0%	11%
Osteoarthritis or osteomyelitis (*Staphylococcus*)	0%	0%	0%	0%	0%	3%	3%	3%	0%	0%	0%	2%	0%	0%	3%	3%	9%	4%	0%	7%
Vertebral osteomyelitis (*E. cecorum*)	3%	0%	0%	3%	0%	3%	3%	0%	0%	2%	10%	4%	3%	3%	0%	6%	4%	8%	0%	7%
Salmonellosis	3%	4%	6%	3%	7%	11%	3%	0%	5%	5%	5%	4%	8%	0%	10%	0%	9%	0%	0%	7%
Coccidiosis	3%	4%	3%	0%	0%	0%	3%	0%	8%	7%	10%	18%	18%	8%	8%	30%	26%	19%	17%	48%
Other bacterial or mixed bacterial diseases	3%	4%	6%	3%	7%	11%	3%	0%	5%	5%	7%	4%	8%	0%	10%	0%	9%	0%	0%	7%

Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive" plus a response to any or combination of the following: clinical sign, post-mortem or laboratory testing to confirm the diagnosis. Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative". Data above was updated from previous year's data where only the flocks with confirmatory diagnosis were reported.

In 2018, other bacterial diseases reported were complex avian pathogenic *E. coli*-associated disease syndromes (septicemia-osteomyelitis and arthritis complex) and unspecified enteric disease (wet droppings but unknown etiology).

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 1. 4 Percentage of broiler flocks reporting the diagnosis of viral and miscellaneous diseases by province/region, 2014 to 2018



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks	29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Diseases																				
Chicken Anemia Virus	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%	3%	4%	0%	0%	7%
Inclusion Body Hepatitis	0%	0%	6%	7%	13%	0%	3%	0%	0%	0%	0%	2%	0%	0%	5%	3%	4%	4%	3%	15%
Infectious Bronchitis Virus	0%	0%	0%	0%	0%	0%	0%	0%	3%	0%	2%	0%	0%	5%	5%	12%	13%	15%	0%	15%
Infectious Bursal Disease	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%	10%	0%	0%	0%	0%	12%	17%	27%	0%	11%
Reovirus	3%	0%	0%	3%	10%	11%	3%	0%	5%	2%	7%	2%	3%	0%	10%	0%	4%	0%	0%	4%
Miscellaneous diseases	3%	0%	0%	3%	7%	11%	3%	0%	5%	2%	5%	2%	3%	0%	10%	0%	4%	0%	3%	4%

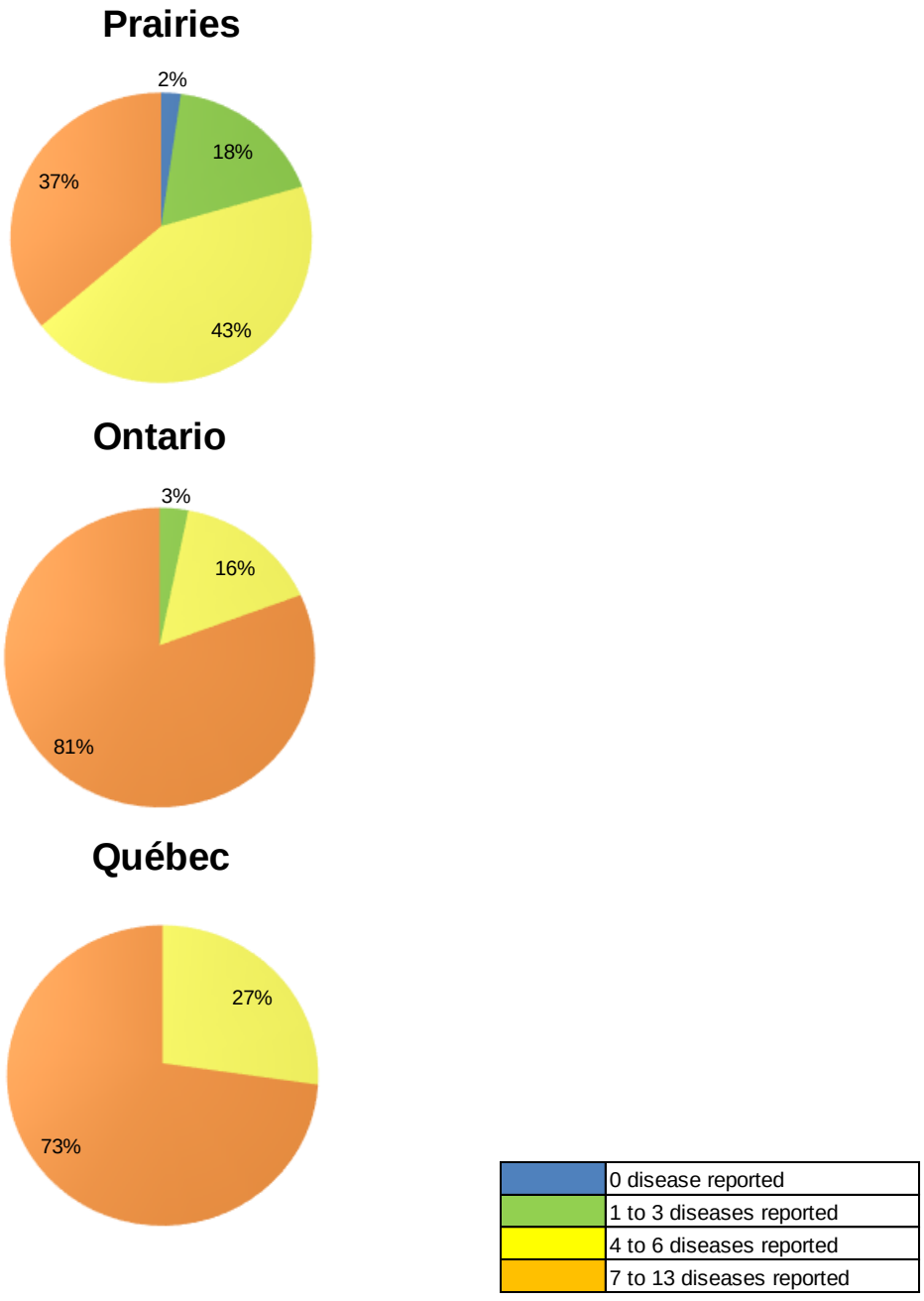
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive" plus a response to any or combination of the following: clinical sign, post-mortem or laboratory testing to confirm the diagnosis. Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative". Data above was updated from previous year's data where only the flocks with confirmatory diagnoses were reported.

In 2018, nicarbazine toxicity was reported (miscellaneous noninfectious disease).

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Grower-finisher pigs

Figure 1. 5 Number of infectious diseases reported by grower-finisher pig herds (n = 97) by province/region, 2018



Number of diseases is tabulated based on the 13 diseases listed on the questionnaire.

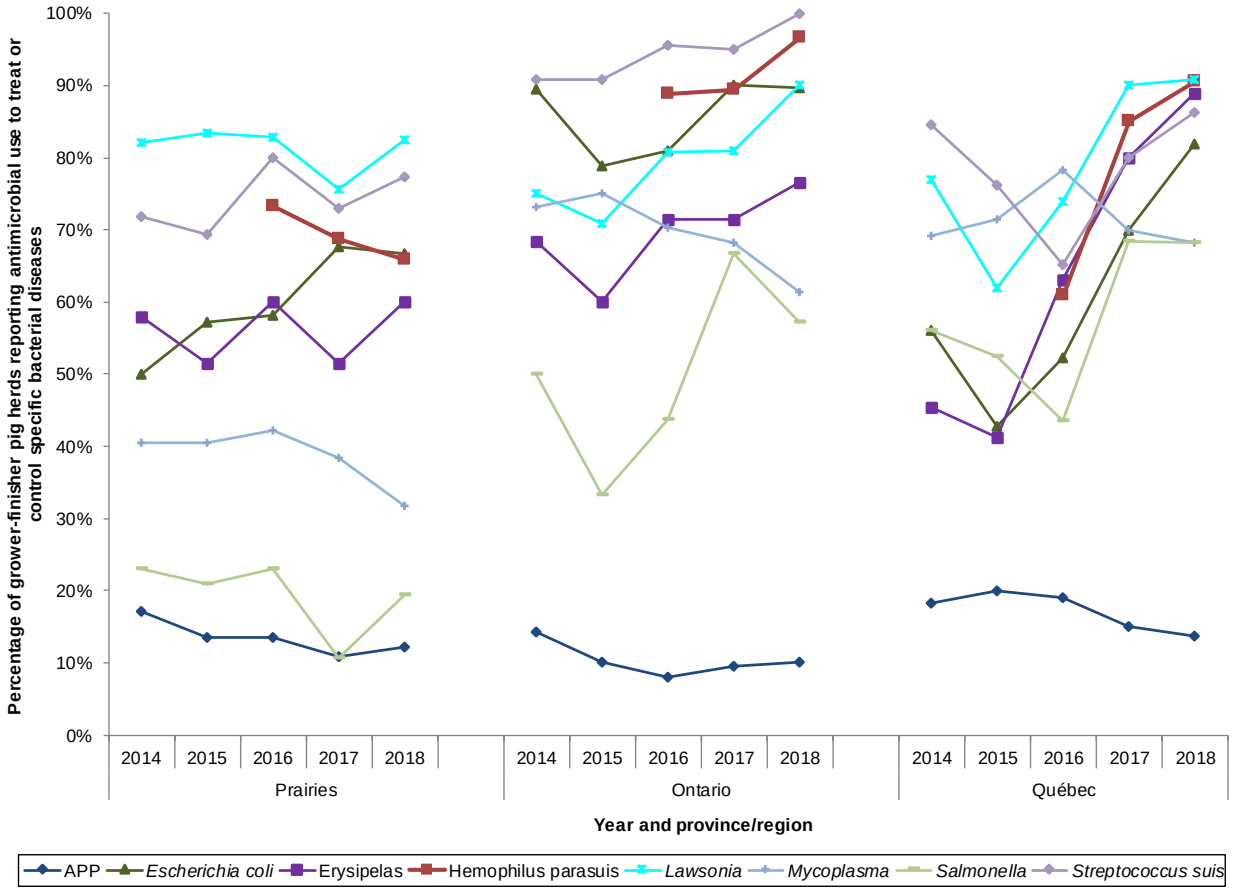
All farms in Ontario reported at least 1 disease on the questionnaire.

Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 1. 6 Reported health status for diseases of grower-finisher pig herds by province/region, 2014 to 2018

a) Bacterial diseases



Province/region	Prairies					Ontario					Québec				
Year	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Disease/bacteria															
APP	17%	14%	14%	11%	12%	14%	10%	8%	10%	10%	18%	20%	19%	15%	14%
Escherichia coli	50%	57%	58%	68%	67%	89%	79%	81%	90%	90%	56%	43%	52%	70%	82%
Erysipelas	58%	51%	60%	51%	60%	68%	60%	71%	71%	77%	45%	41%	63%	80%	89%
Hemophilus parasuis	NA	NA	73%	69%	66%	NA	NA	89%	89%	97%	NA	NA	61%	85%	90%
Lawsonia	82%	83%	83%	76%	83%	75%	71%	81%	81%	90%	77%	62%	74%	90%	91%
Mycoplasma	40%	41%	42%	38%	32%	73%	75%	70%	68%	61%	69%	71%	78%	70%	68%
Salmonella	23%	21%	23%	11%	19%	50%	33%	44%	67%	57%	56%	52%	43%	68%	68%
Streptococcus suis	72%	69%	80%	73%	77%	91%	91%	96%	95%	100%	85%	76%	65%	80%	86%

APP = *Actinobacillus pleuropneumoniae*.

Hemophilus parasuis, added to the questionnaire in 2016. NA = not available.

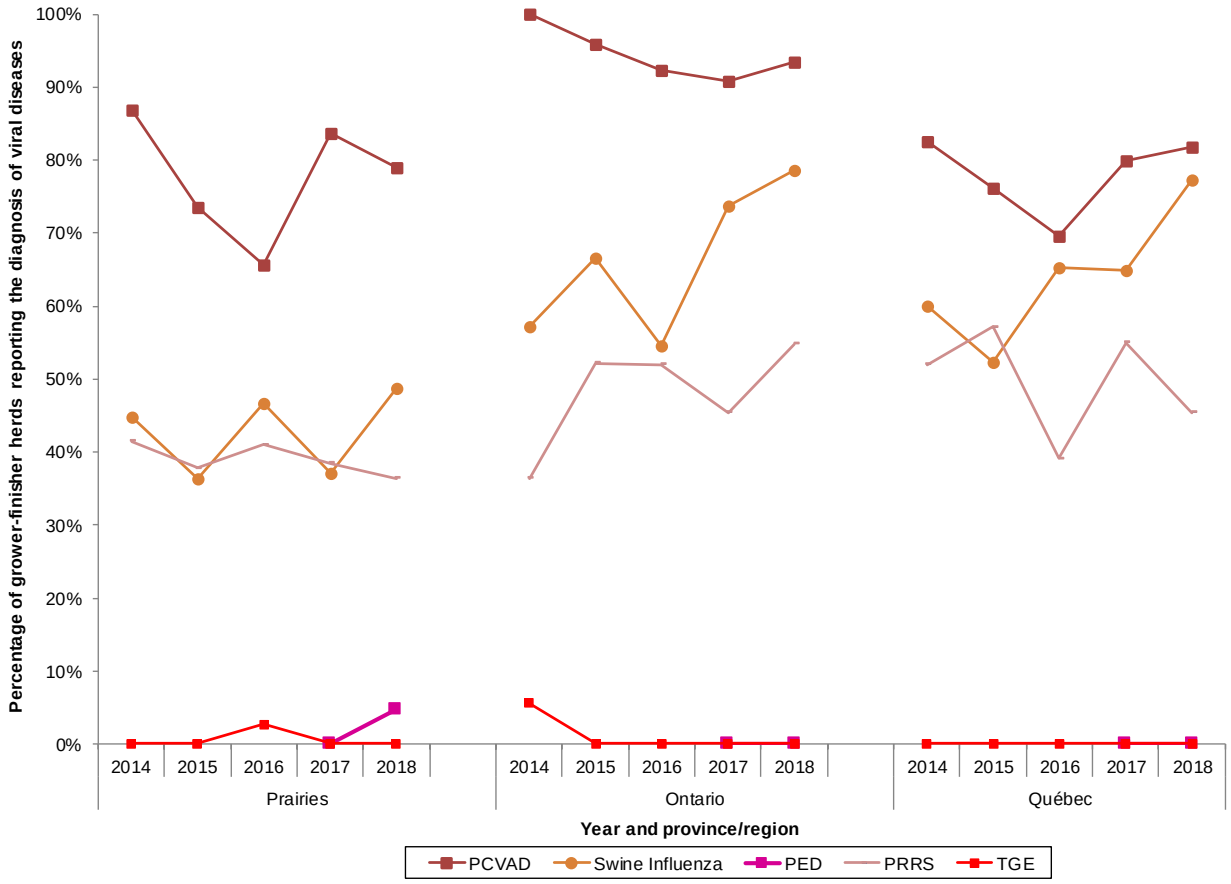
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

Health status of nurseries and sow herds supplying CIPARS grower-finisher pig herds is available upon request.

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 1. 6 Reported health status for diseases of grower-finisher pig herds by province/region, 2014 to 2018 (continued)

b) Viral diseases



Province/region	Prairies					Ontario					Québec				
Year	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Disease/virus															
PCVAD	87%	74%	66%	84%	79%	100%	96%	92%	91%	94%	83%	76%	70%	80%	82%
Swine Influenza	45%	36%	47%	37%	49%	57%	67%	55%	74%	79%	60%	52%	65%	65%	77%
PED	NA	NA	0%	0%	5%	NA	NA	0%	0%	0%	NA	NA	0%	0%	0%
PRRS	41%	38%	41%	38%	36%	36%	52%	52%	45%	55%	52%	57%	39%	55%	45%
TGE	0%	0%	3%	0%	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%

PCVAD = Porcine Circovirus Associated Disease.

PED = Porcine Epidemic Diarrhea, added to the questionnaire in 2016. NA = not available.

PRRS = Porcine Reproductive and Respiratory Syndrome.

TGE = Transmissible Gastroenteritis.

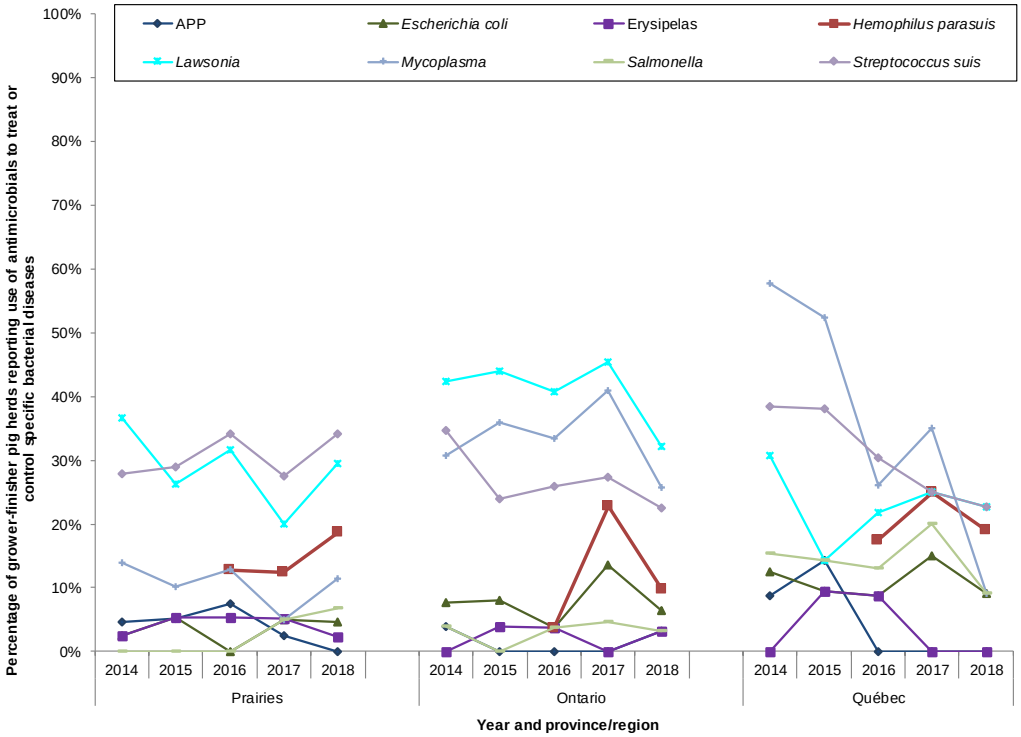
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

Health status of nurseries and sow herds supplying CIPARS grower-finisher herds is available upon request.

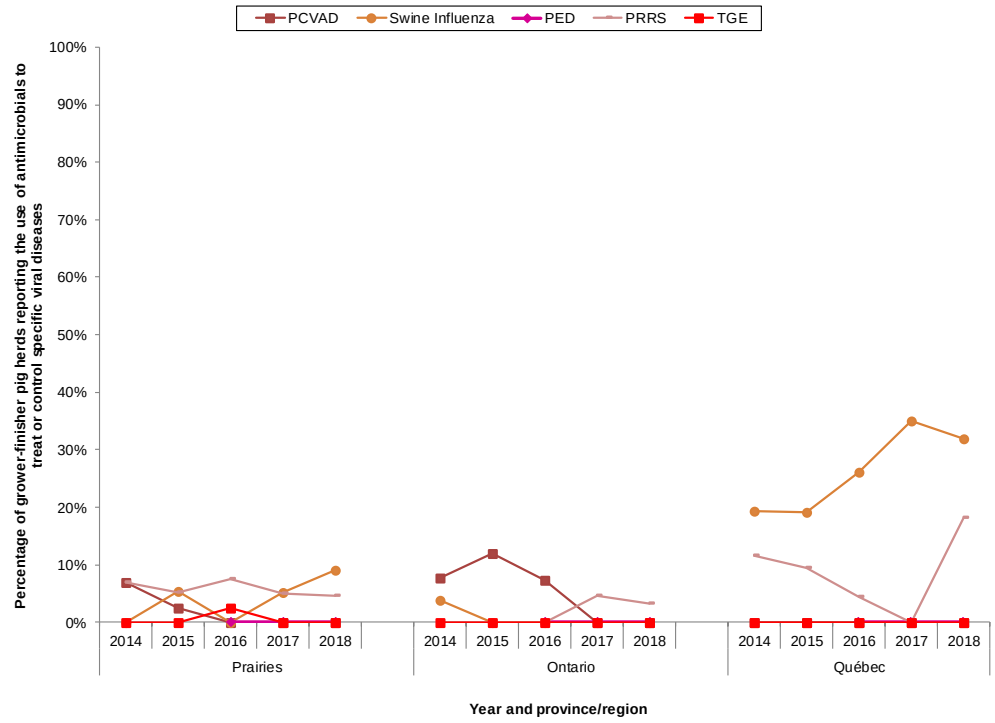
The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 1. 7 Reported antimicrobial use for specific diseases in grower-finisher pig herds by province/region, 2014 to 2018

a) Bacterial diseases



b) Viral diseases



See corresponding footnotes on next page.

Figure 1. 7 Reported antimicrobial use for specific diseases in grower-finisher pig herds by province/region, 2014 to 2018 (continued)

APP = *Actinobacillus pleuropneumoniae. Hemophilus parasuis*, added to the questionnaire in 2016.

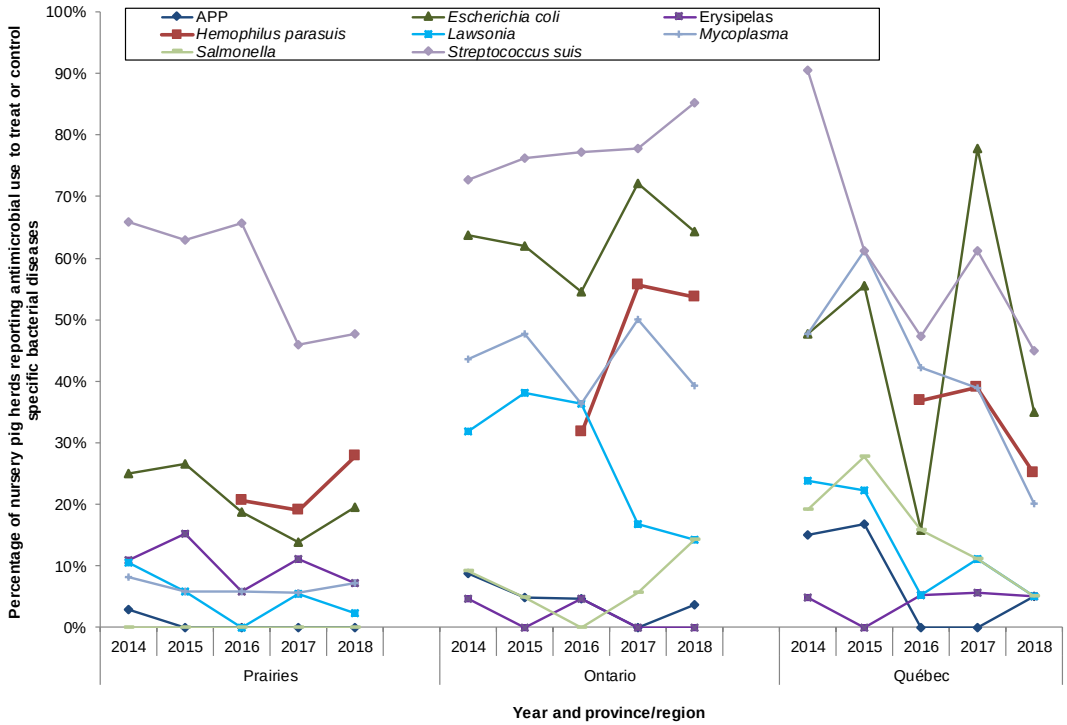
PCVAD = Porcine Circovirus Associated Disease. PED = Porcine Epidemic Diarrhea, added to the questionnaire in 2016. PRRS = Porcine Reproductive and Respiratory Syndrome. TGE = Transmissible Gastroenteritis.

Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

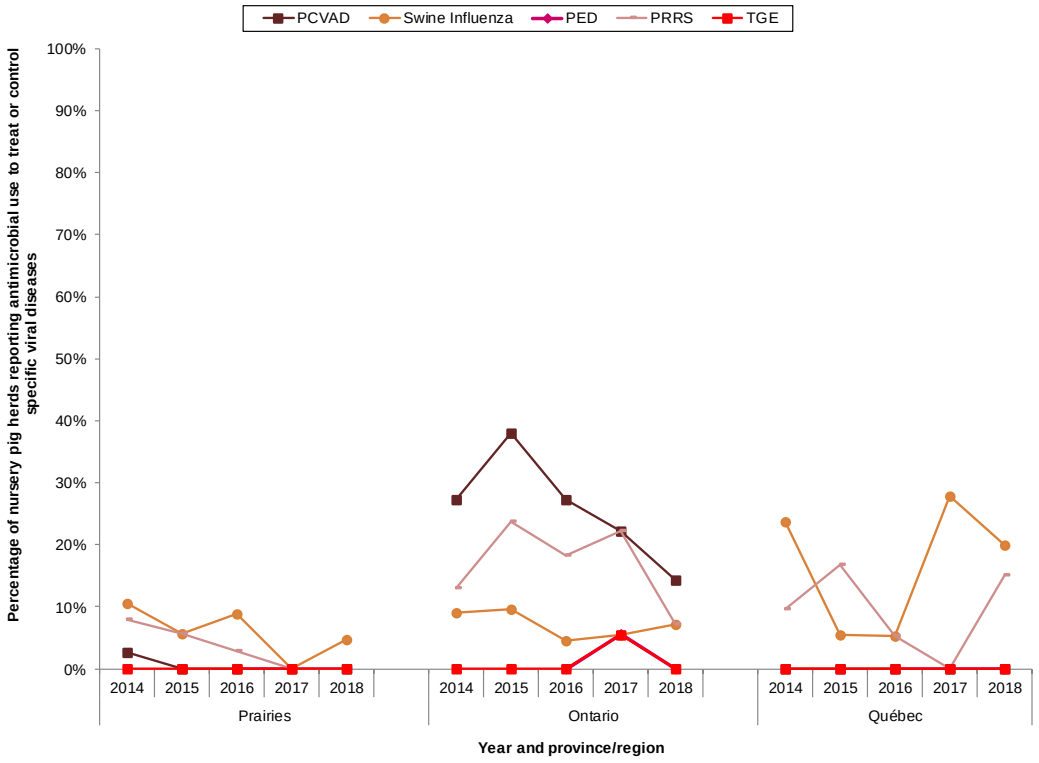
The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 1. 8 Reported antimicrobial use for specific diseases in nurseries supplying grower-finisher herds by province/region, 2014 to 2018

a) Bacterial diseases



b) Viral diseases



See corresponding footnotes on next page.

Figure 1. 8 Reported antimicrobial use for specific diseases in nurseries supplying grower-finisher herds by province/region, 2014 to 2018 (continued)

APP = *Actinobacillus pleuropneumoniae*. *Hemophilus parasuis*, added to the questionnaire in 2016.

PCVAD = Porcine Circovirus Associated Disease. PED = Porcine Epidemic Diarrhea, added to the questionnaire in 2016. PRRS = Porcine Reproductive and Respiratory Syndrome. TGE = Transmissible Gastroenteritis.

Not all questionnaires were completed for all diseases listed.

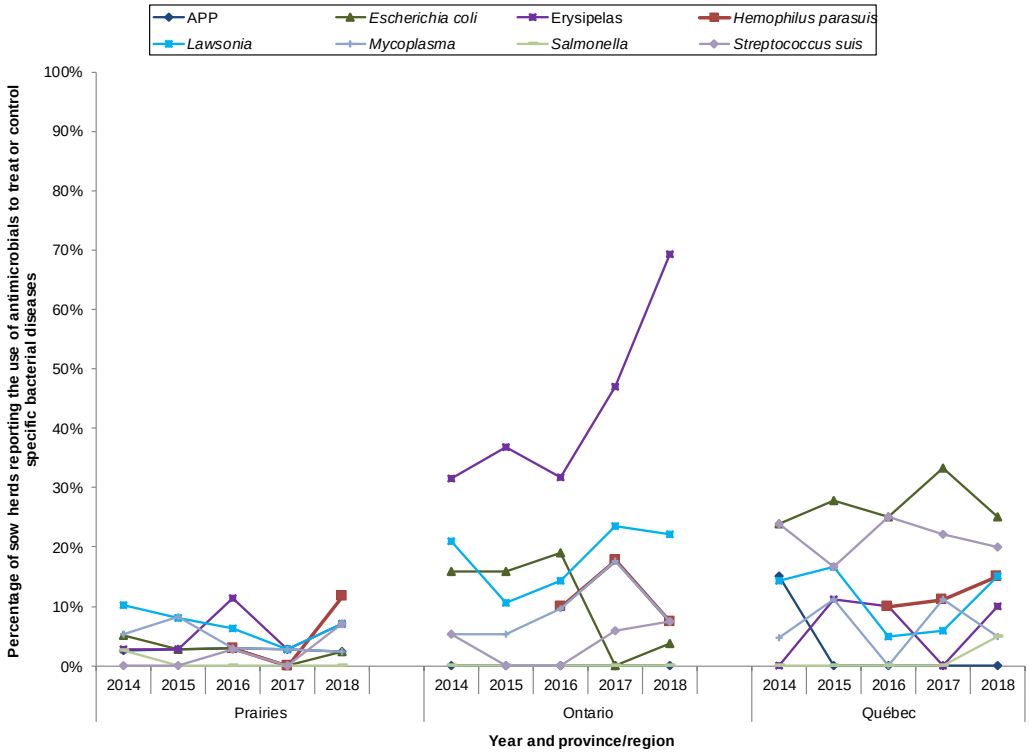
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

There are 3 primary stages of pig production: suckling pigs (pre-weaning, in sow herds), nursery pigs (weaning to 25 kg), and grower-finisher pigs (25 kg to market weight). Data on antimicrobial use in suckling and nursery pigs is required to understand total antimicrobial exposure.

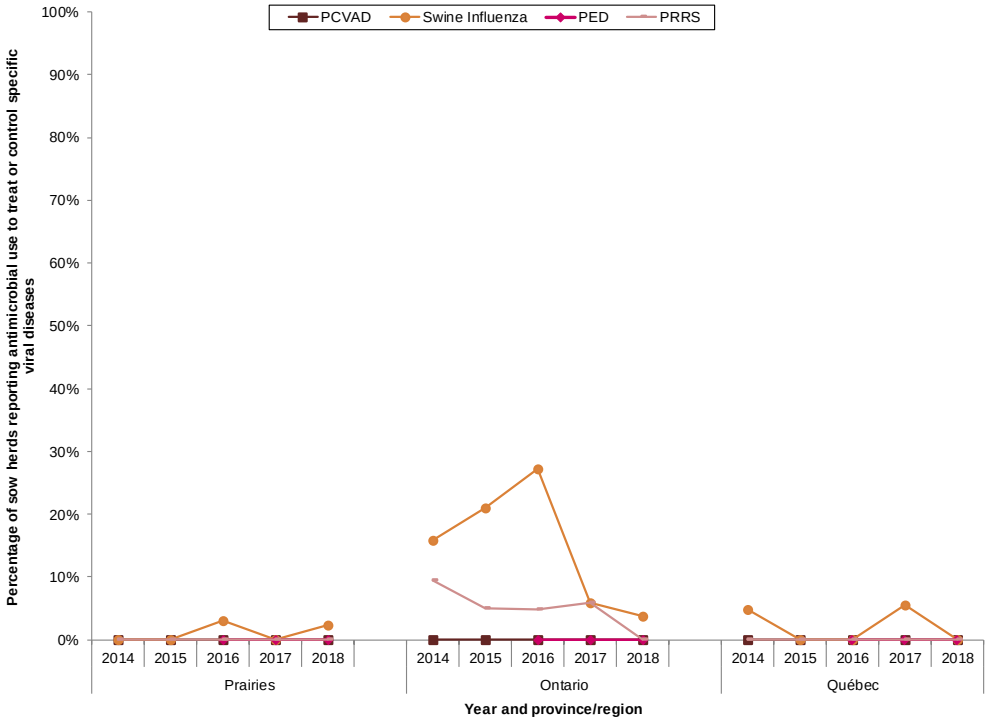
The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 1. 9 Reported antimicrobial use for specific diseases in sow herds supplying grower-finisher pig herds by province/region, 2014 to 2018

a) Bacterial diseases



a) Viral diseases



See corresponding footnotes on next page.

Figure 1. 9 Reported antimicrobial use for specific diseases in sow herds supplying grower-finisher pig herds by province/region, 2014 to 2018 (continued)

APP = *Actinobacillus pleuropneumoniae. Hemophilus parasuis*, added to the questionnaire in 2016. PCVAD = Porcine Circovirus Associated Disease. PED = Porcine Epidemic Diarrhea, added to the questionnaire in 2016. PRRS = Porcine Reproductive and Respiratory Syndrome. Transmissible Gastroenteritis (TGE) was not included in the sow herd survey.

Not all questionnaires were completed for all diseases listed.

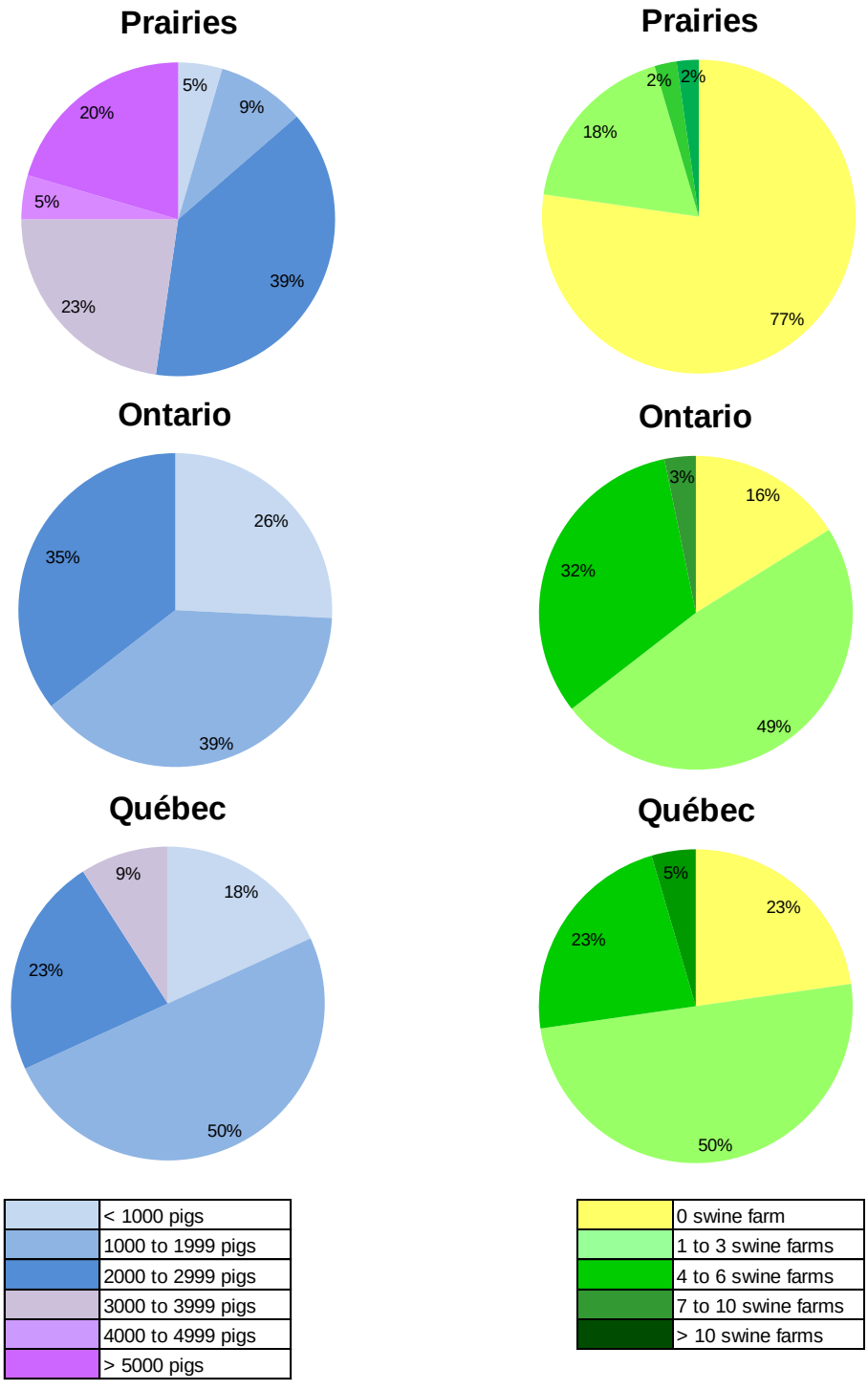
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

There are 3 primary stages of pig production: suckling pigs (pre-weaning, in sow herds), nursery pigs (weaning to 25 kg), and grower-finisher pigs (25 kg to market weight). Data on antimicrobial use in suckling and nursery pigs is required in order to understand total antimicrobial exposure.

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 1. 10 Demographics of grower-finisher pig herds by province/region (n = 97), 2018

a) Barn Capacity



b) Number of swine farms within 2 km

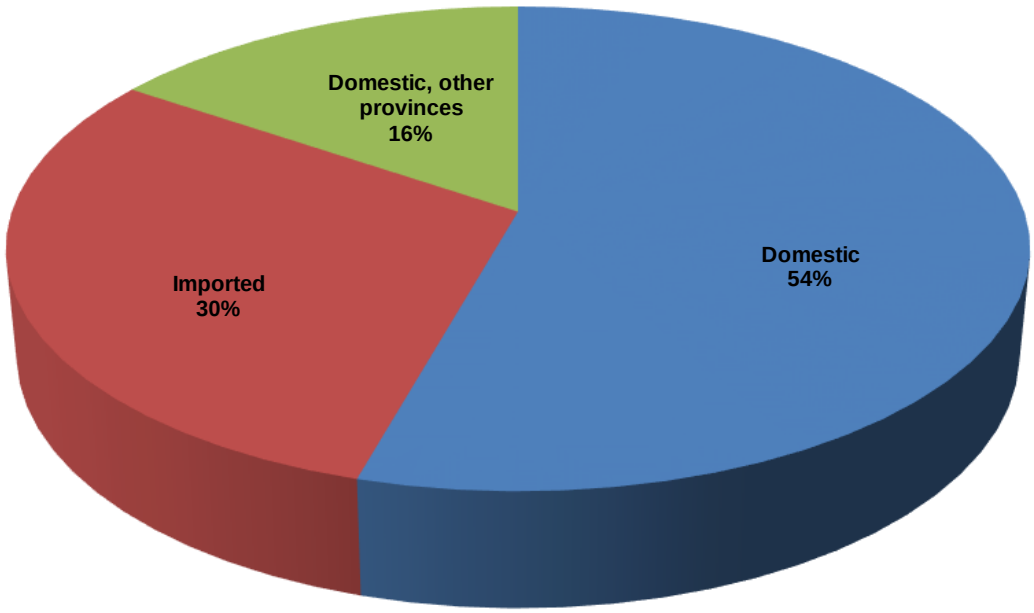
Capacity indicates the maximum number of pigs that the barn is designed to house.

Participating herds may have additional barns that were not sampled for the CIPARS program therefore this barn capacity is not necessarily equivalent to grower-finisher herd size.

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Turkeys

Figure 1. 11 Relative distribution of turkey poult sources, 2018

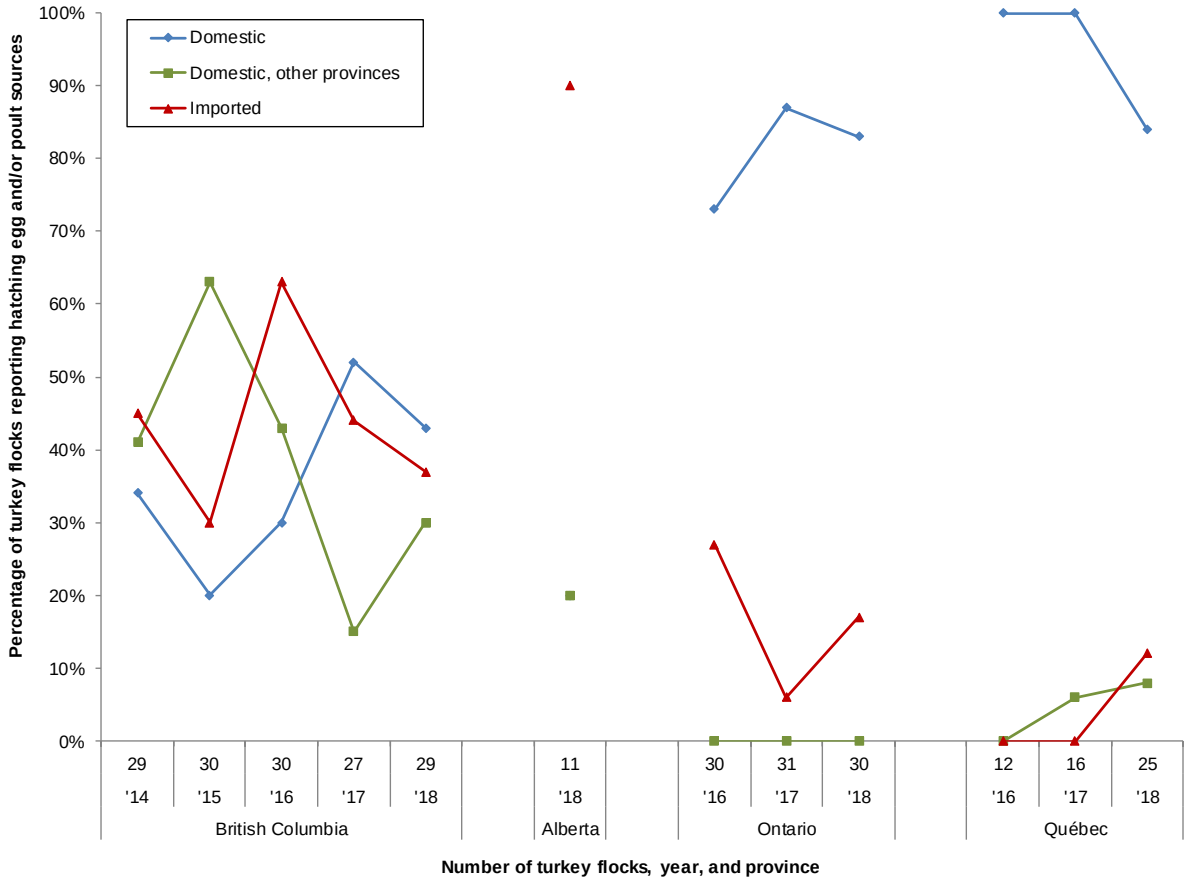


Domestic = hatching eggs originated and/or poults hatched from hatcheries located in the province where the birds were raised.

Domestic, other provinces = hatching eggs originated and/or poults hatched from hatcheries located in provinces other than the province where the birds were raised

Imported = hatching eggs/poults were sourced by the importing hatchery from the United States or other countries; there were hatching eggs from domestic breeders hatched in United States hatcheries and then delivered/reared in Canadian turkey farms.

Figure 1. 12 Sources of hatching eggs and/or poults placed in the barn sampled by province, 2014 to 2018



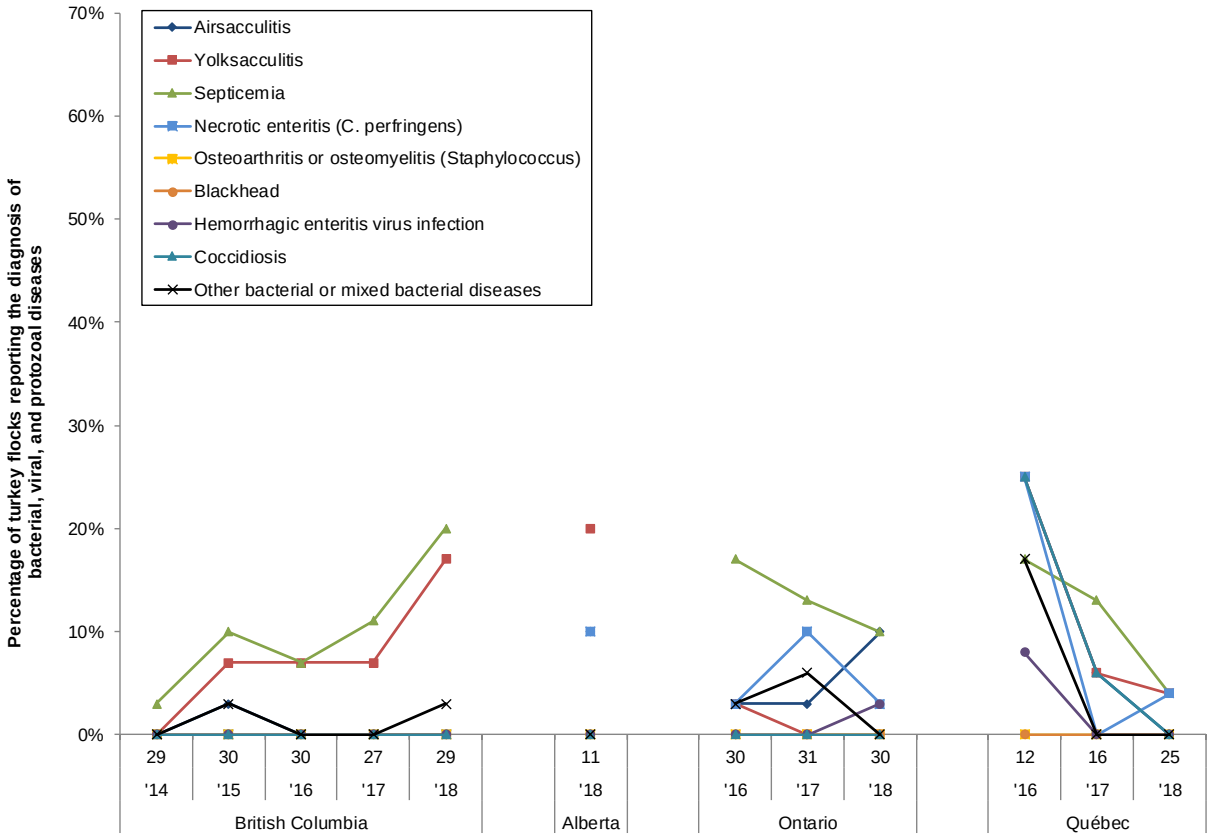
Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Hatching egg and/or poult sources												
Domestic	34%	20%	30%	52%	43%	20%	73%	87%	83%	100%	100%	84%
Domestic, other provinces	41%	63%	43%	15%	30%	20%	0%	0%	0%	0%	6%	8%
Imported	45%	30%	63%	44%	37%	90%	27%	6%	17%	0%	0%	12%

Domestic = hatched from hatcheries located in the province where the birds were raised.

Domestic, other provinces = hatched from hatcheries located in provinces other than the province where the birds were raised.

Imported = hatching eggs and/or poults were sourced by importing hatchery from the United States or other countries.

Figure 1. 13 Percentage of turkey flocks reporting bacterial, viral, and protozoal diseases by province, 2014 to 2018



Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Bacterial, viral, and protozoal diseases												
Airsacculitis	0%	3%	0%	0%	0%	10%	3%	3%	10%	25%	6%	0%
Yolksacculitis	0%	7%	7%	7%	17%	20%	3%	0%	0%	25%	6%	4%
Septicemia	3%	10%	7%	11%	20%	0%	17%	13%	10%	17%	13%	4%
Necrotic enteritis (*C. perfringens*)	0%	0%	0%	0%	0%	10%	3%	10%	3%	25%	0%	4%
Osteoarthritis or osteomyelitis (*Staphylococcus*)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Blackhead	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hemorrhagic enteritis virus infection	0%	0%	0%	0%	0%	0%	0%	0%	3%	8%	0%	0%
Coccidiosis	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%	6%	0%
Other bacterial or mixed bacterial diseases	0%	3%	0%	0%	3%	0%	3%	6%	0%	17%	0%	0%

Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive" plus a response to any or combination of the following: clinical sign, post-mortem or laboratory testing to confirm the diagnosis. Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative". Data above was updated from previous year's data where only the flocks with confirmatory diagnosis were reported.
In 2018, other bacterial diseases reported were unspecified *E. coli*-associated disease syndromes and *Ornithobacterium rhinotracheale*.

Chapter 2 Antimicrobial use in animals

Quantities of antimicrobials distributed for sale for use in animals

National-level antimicrobial distribution data

Table 2. 1 Quantity of antimicrobials (kg) distributed in Canada for sale for use in animals, 2009 to 2018

Antimicrobial class aggregation	Quantity of active ingredient (kg)										Change (%) from 2009 to 2018	Change (%) from 2017 to 2018
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		
Aminoglycosides											NA	NA
Aminoglycosides	4,652	3,961									NA	NA
Aminoglycosides			12,242	10,372	10,785						NA	NA
Aminoglycosides						13,276	13,718	13,213	11,477	13,709	NA	19%
Amphenicols	4,001	4,391									NA	NA
β-Lactams (penicillins)											NA	NA
β-Lactams (penicillins)	118,109	201,934									NA	NA
β-Lactams (penicillins)			147,853								NA	NA
β-Lactams (penicillins)				136,611							NA	NA
β-Lactams (penicillins)					134,838	139,278	139,565	110,818			NA	NA
β-Lactams (penicillins)									107,548	113,653	NA	6%
Cephalosporins	NA	NA									NA	NA
Cephalosporins			6,716	6,388	2,403	6,812	6,795	6,581	6,795	6,698	NA	-1%
Fluoroquinolones	377	381	519	406	469	782	860	575	640	677	79%	6%
Lincosamides	44,137	46,373	43,256	51,027	54,784	60,006	65,646	48,052	50,225	47,228	7%	-6%
Macrolides and pleuromutilins											NA	NA
Macrolides, pleuromutilins, and bacitracins	204,169	170,154									NA	NA
Macrolides	NA	NA	108,858	98,622	93,870	112,340	114,186	96,653			NA	NA
Macrolides									89,986	87,221	NA	-3%
Other antimicrobials											NA	NA
Other antimicrobials	21,339	26,757									NA	NA
Other antimicrobials			130,899								NA	NA
Other antimicrobials				129,614							NA	NA
Other antimicrobials					125,511						NA	NA
Other antimicrobials						125,178	128,144	121,634			NA	NA
Other antimicrobials									118,971	116,700	NA	-2%
Tetracyclines	686,832	535,142	600,918	635,435	635,675	599,540	659,784	596,823			NA	NA
Tetracyclines									501,582	560,643	NA	12%
Trimethoprim and sulfonamides	57,596	48,221	70,454	58,716							NA	NA
Trimethoprim and sulfonamides					63,367	69,255	72,564	68,878			NA	NA
Trimethoprim and sulfonamides									61,392	57,865	NA	-6%
Total	**1,141,213**	**1,037,313**	**1,121,715**	**1,127,191**	**1,121,702**	**1,126,467**	**1,201,263**	**1,063,227**	**948,615**	**1,004,392**	**-12%**	**6%**

See corresponding footnotes on next pages.

Table 2. 1 Quantity of antimicrobials (kg) distributed in Canada for sale for use in animals, 2009 to 2018 (continued)

NA = not available or not applicable.

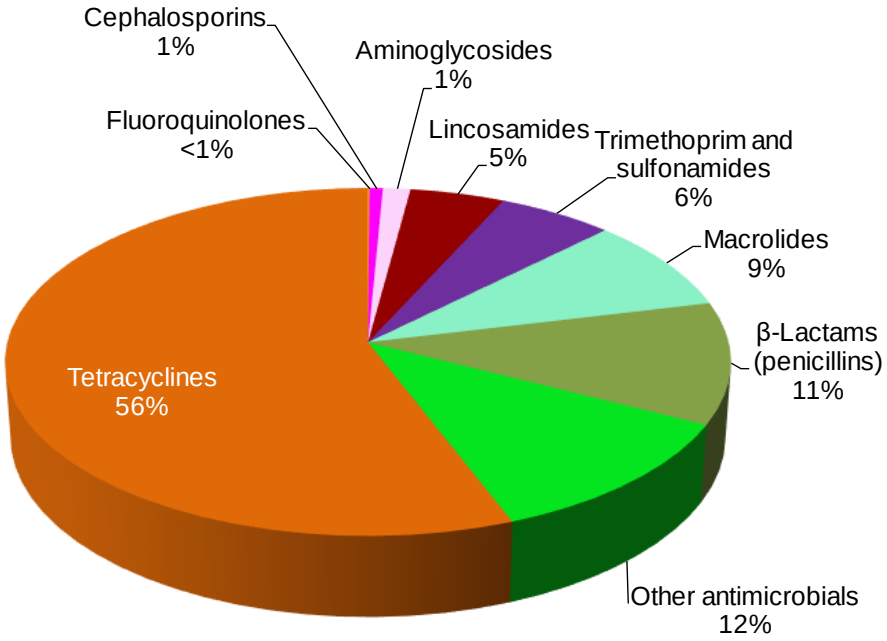
Changes in percentage over time from 2009 to 2018 are relative to the quantities reported in 2009. Changes in percentage over time from 2017 to 2018 are relative to the quantities reported in 2017.

Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

CAHI provides the information according to a "3 company accounting rule" established by CAHI to comply with the European Union and the United States' anti-competition regulations. CAHI added in some cases a "90% rule" to be sure not to infringe the regulations in the United States. These accounting rules can result in changes to the categorization of specific antimicrobials over time; hence within an antimicrobial category, columns with different colours should not be compared.

"Other antimicrobials" for 2018 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

Figure 2. 1 Percentages of the quantities (kg of active ingredient) of antimicrobials distributed in Canada for sale for use in animals, 2018



Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

"Other antimicrobials" for 2018 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

Provincial-level antimicrobial distribution data

Table 2. 2 Quantity of antimicrobials (kg of active ingredient) distributed for sale for use in animals by province, 2017 to 2018

Year	Province	Aminoglycosides	β-Lactams (penicillins)	Cephalosporins	Fluoroquinolones	Lincosamides	Macrolides	Other antimicrobials	Tetracyclines	Trimethoprim and sulfonamides	Total
2018	BC	3,228	7,327	903	60	96	252	16,909	15,463	2,328	46,567
	AB	322	14,562	1,031	275	6,017	37,302	18,831	138,613	10,270	227,223
	SK	654	3,653	255	11	1,479	2,889	3,547	20,202	4,055	36,745
	MB	974	15,723	361	26	7,027	12,974	10,151	89,988	6,577	143,801
	ON	4,801	47,868	2,319	244	17,196	20,882	34,802	140,868	25,280	294,258
	QC	3,607	23,080	1,412	49	15,387	12,779	30,658	151,140	8,716	246,828
	NS	37	508	197	6	12	114	1,592	1,059	243	3,768
	NB	59	556	127	3	9	14	80	3,125	225	4,200
	PE	7	222	37	2	2	10	55	159	140	634
	NL	20	154	54	2	3	6	75	24	30	368
Total		**13,709**	**113,653**	**6,698**	**677**	**47,228**	**87,221**	**116,700**	**560,643**	**57,865**	**1,004,392**
2017	BC	1,070	6,781	907	63	101	442	14,022	7,770	2,098	33,254
	AB	811	11,542	1,012	181	6,684	36,284	18,059	109,588	10,167	194,330
	SK	342	2,854	245	13	1,863	3,125	4,051	19,690	2,798	34,982
	MB	1,488	19,859	325	24	8,401	11,878	10,851	76,831	6,780	136,438
	ON	3,509	39,530	2,403	275	16,021	20,030	37,645	126,545	23,548	269,505
	QC	4,159	25,573	1,488	68	17,129	18,000	33,007	149,541	14,914	263,879
	NS	54	549	194	7	14	200	1,119	10,976	351	13,463
	NB	28	500	121	4	6	12	97	440	543	1,752
	PE	5	212	38	2	2	10	59	180	161	670
	NL	12	146	61	2	4	4	62	20	33	343
Total		**11,477**	**107,548**	**6,795**	**640**	**50,225**	**89,986**	**118,971**	**501,582**	**61,392**	**948,616**

Province abbreviations are defined in the Appendix.

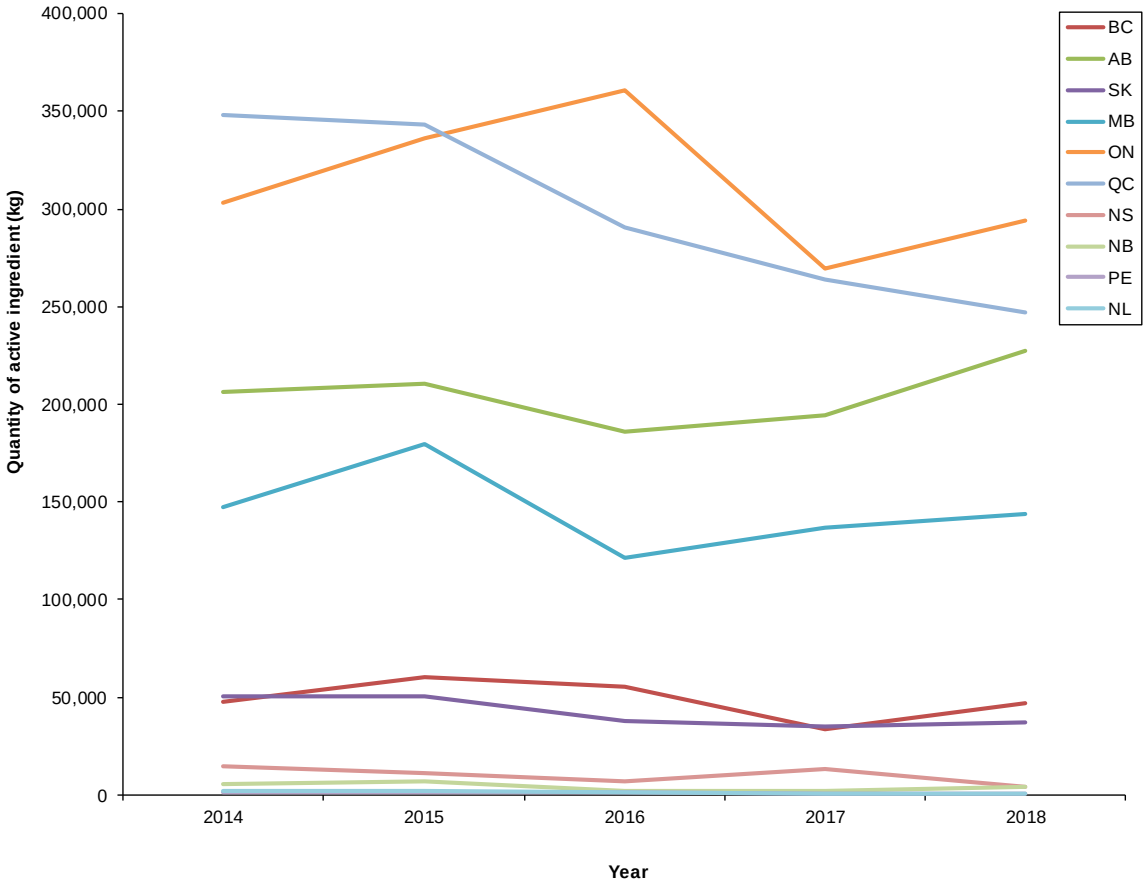
CAHI accounting rules can result in changes of antimicrobial categorizations over time. Please consult the CIPARS 2018: Design and methods to determine whether an appropriate comparison across years can be made for that antimicrobial class.

There may be subsequent distribution of antimicrobials across provincial borders after being distributed to the veterinary clinics.

Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

"Other antimicrobials" for 2018 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

Figure 2. 2 Quantity of antimicrobials (kg of active ingredient) distributed for sale for use in animals by province, 2014 to 2018



This figure does not account for provincial differences in numbers or types of animals.

Province abbreviations are defined in the Appendix.

There may be subsequent distribution of antimicrobials across provincial borders after being distributed to the veterinary clinics.

Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

Distribution by animal type

Table 2. 3 Quantity of antimicrobials (kg of active ingredient) distributed for sale for use in animals by province and animal type, 2018

Animal type / province	Aminoglycosides	β-Lactams (penicillins)	Cephalosporins	Fluoroquinolones	Lincosamides	Macrolides	Other antimicrobials	Tetracyclines	Trimethoprim and sulfonamides	Total
Production animal										
BC	3,225	6,641	138	33	31	252	16,894	15,448	1,993	44,657
AB	320	13,991	489	255	5,969	37,302	18,823	138,598	9,772	225,519
SK	653	3,516	109	8	1,473	2,889	3,544	20,201	3,978	36,371
MB	974	15,546	208	20	7,018	12,974	10,149	89,981	6,248	143,118
ON	4,795	46,218	499	166	17,084	20,882	34,778	140,793	23,475	288,690
QC	3,604	22,353	513	23	15,360	12,779	30,633	151,112	8,381	244,758
NS	37	365	24	1	6	114	1,587	1,049	150	3,334
NB	58	445	17	0	4	14	78	3,123	165	3,906
PE	7	204	16	1	1	10	54	159	87	539
NL	19	98	10	0	0	6	74	23	27	259
Total	**13,693**	**109,378**	**2,026**	**508**	**46,947**	**87,221**	**116,614**	**560,487**	**54,276**	**991,150**
Companion animal										
BC	2	686	765	28	64	0	14	15	335	1,909
AB	2	572	542	20	48	0	8	15	498	1,704
SK	1	136	146	2	7	0	3	2	77	375
MB	1	176	153	6	9	0	2	7	329	683
ON	6	1,650	1,819	77	112	0	24	76	1,805	5,569
QC	3	728	899	25	27	0	25	28	335	2,070
NS	1	142	173	5	6	0	5	10	93	434
NB	1	111	110	3	5	0	2	3	61	294
PE	0	18	21	1	1	0	0	0	53	95
NL	0	56	44	2	3	0	2	1	3	109
Total	**16**	**4,275**	**4,671**	**169**	**281**	**0**	**85**	**155**	**3,589**	**13,242**
Total (animal types combined)										
	13,709	**113,653**	**6,698**	**677**	**47,228**	**87,221**	**116,700**	**560,643**	**57,865**	**1,004,392**

Production animals include horses.

Province abbreviations are defined in the Appendix.

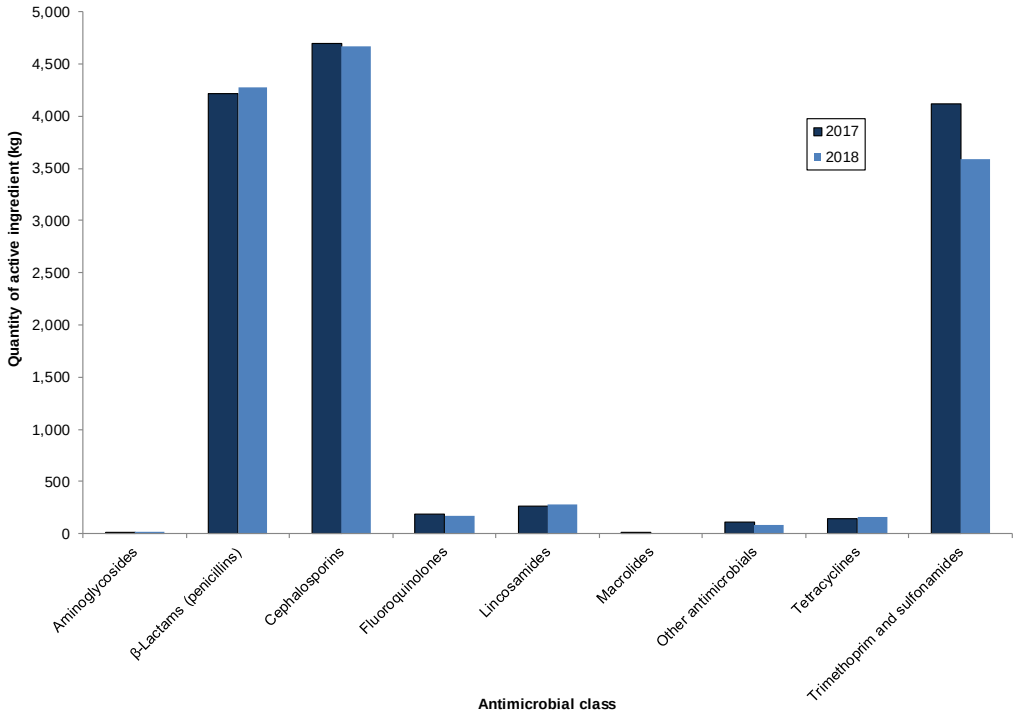
The attribution of antimicrobials sold in each province to the type of animal (companion animals vs. production animals) was based on multiplying a national average percentage of the antimicrobial sold for companion animals/production animals by the total quantities reported for that province by the manufacturers.

Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

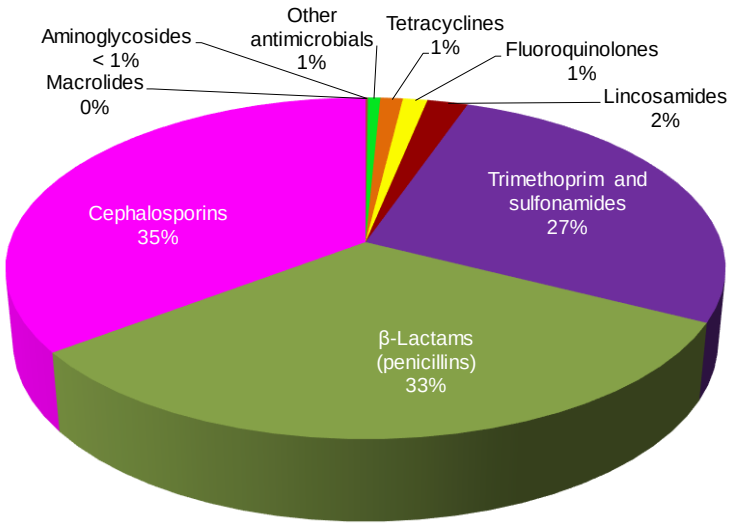
"Other antimicrobials" for 2018 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

Figure 2. 3 Quantity of antimicrobials (kg of active ingredient) distributed for sale for use in companion animals over time and in 2018

a) Over time



b) 2018



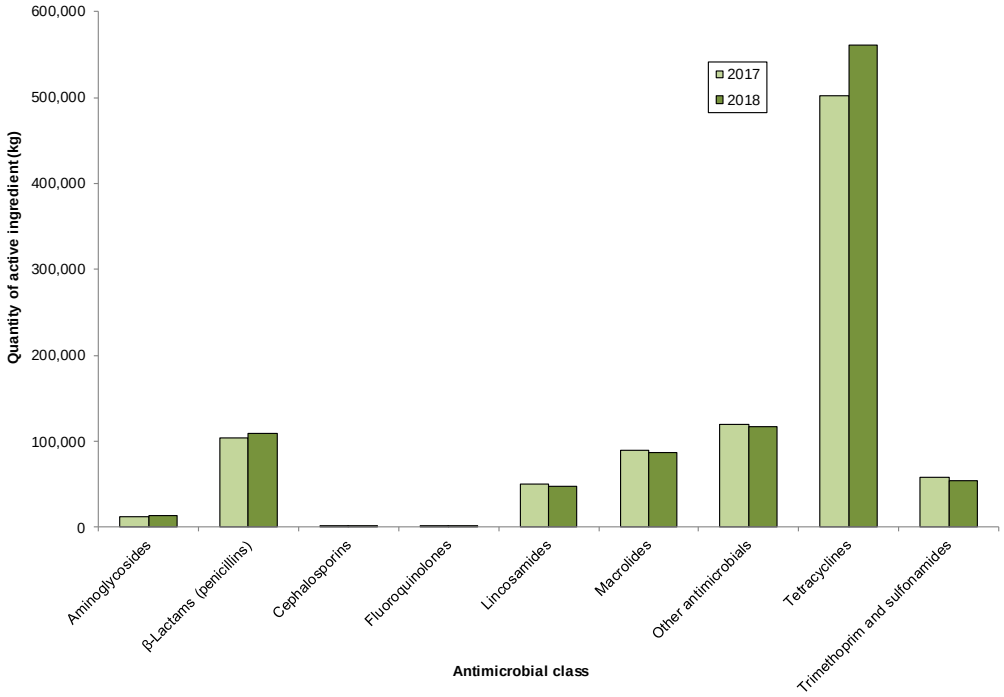
Antimicrobial sales were assigned to animal type according to label claim and in the situation where mixed species was indicated on the label, the manufacturer assigned the kg to either "Companion animal" or "Production animal".

Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

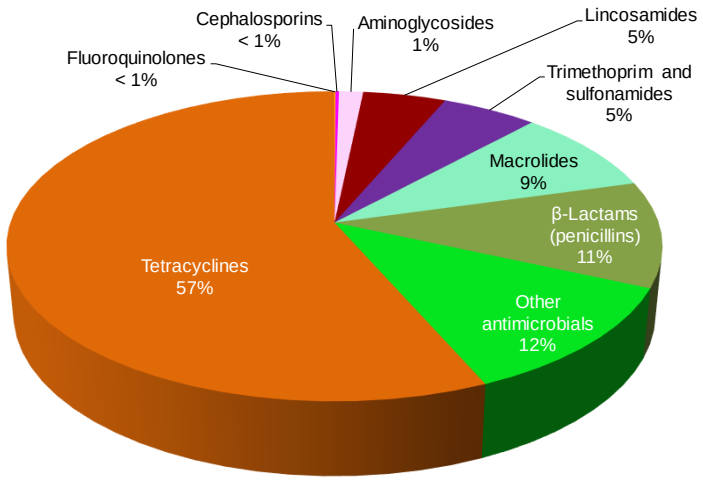
"Other antimicrobials" for 2018 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

Figure 2. 4 Quantity of antimicrobials (kg of active ingredient) distributed for sale for use in production animals over time and in 2018

a) Over time



b) 2018



Note the differences in scale of the vertical axes between the companion animal figure (Figure 2. 3a) and the production animal figure. Production animals include horses.

Antimicrobial sales were assigned to animal type according to label claim and in the situation where mixed species was indicated on the label, the manufacturer assigned the kg to either "Companion animal" or "Production animal".

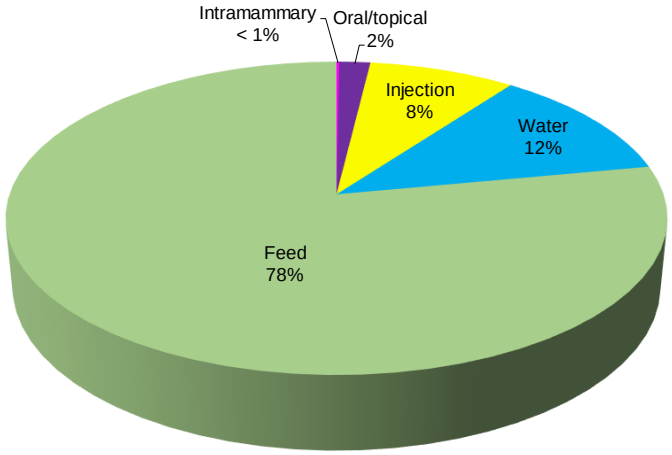
Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

"Other antimicrobials" for 2018 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

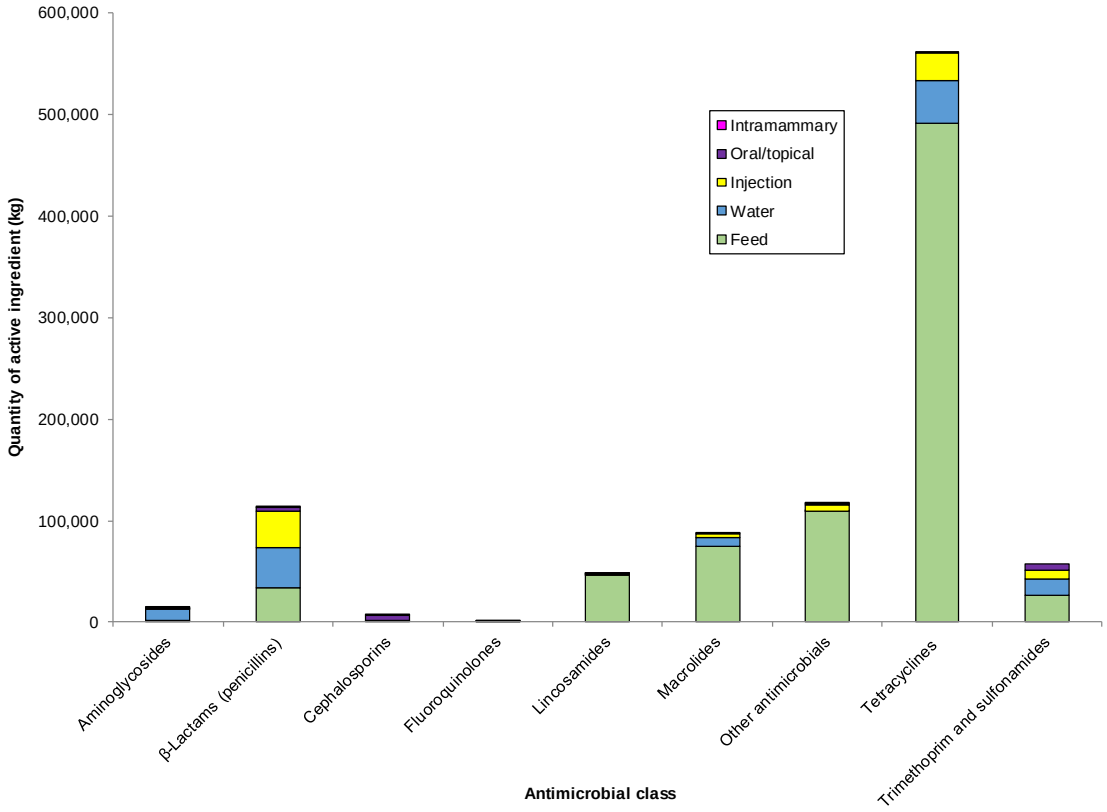
Distribution by route of administration

Figure 2. 5 Quantity of antimicrobials (% of total kg and kg of active ingredient) distributed for sale for use in animals, by route of administration and antimicrobial class, 2018

a) Route of administration



b) Antimicrobial class

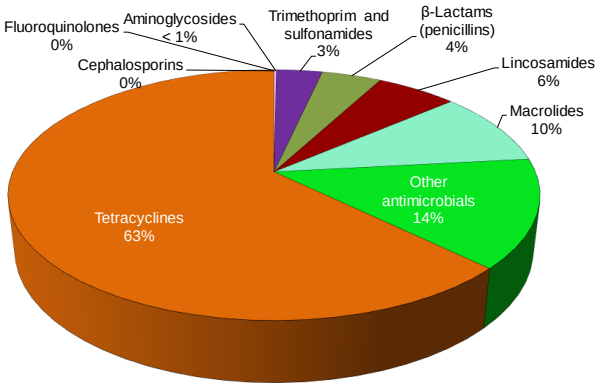


Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

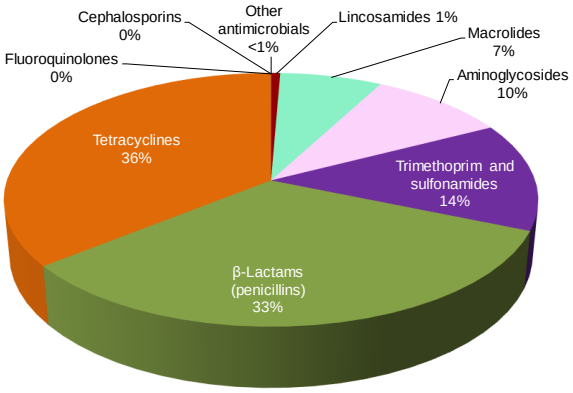
"Other antimicrobials" for 2018 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymixin B, tiamulin, and virginiamycin.

Figure 2. 6 Quantity of antimicrobials (% of total kg) distributed for sale for use in animals, by route of administration (feed, water, injection, oral or topical, and intra-mammary), 2018

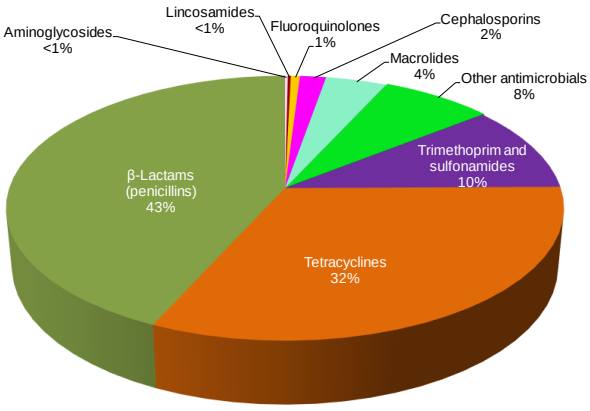
a) Feed



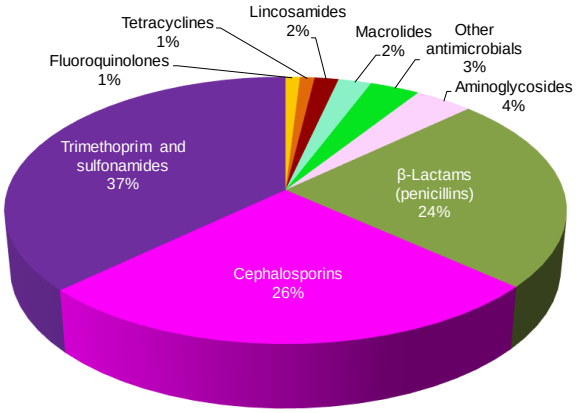
b) Water



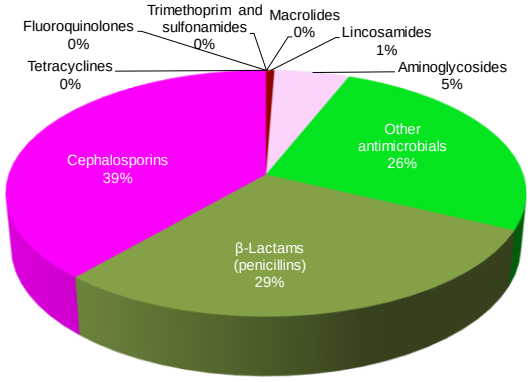
c) Injection



d) Oral or topical



e) Intra-mammary

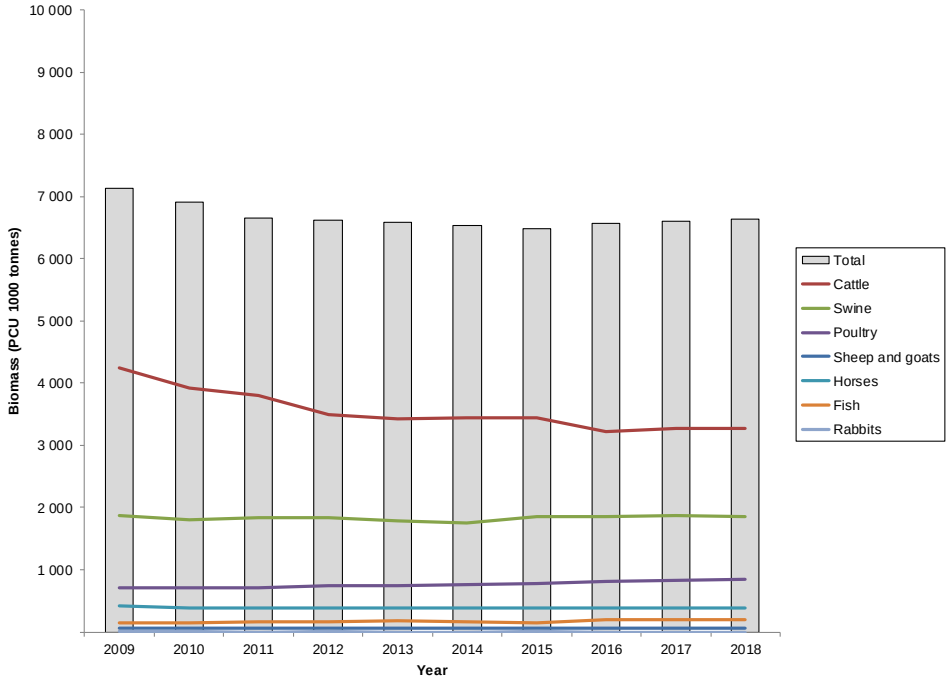


Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

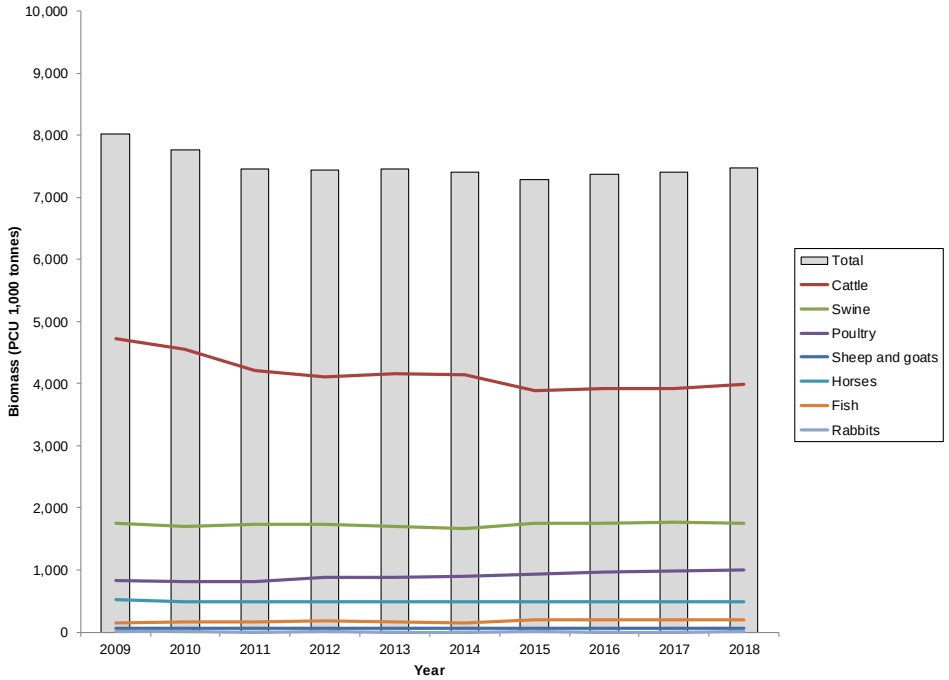
"Other antimicrobials" for 2018 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

Figure 2. 7 Biomass as measured by the population correction unit (PCU in 1,000 tonnes) over time; using European Surveillance of Veterinary Antimicrobial Consumption production classes and European weights or proposed Canadian weights, 2009 to 2018

a) European weights



b) Canadian weights



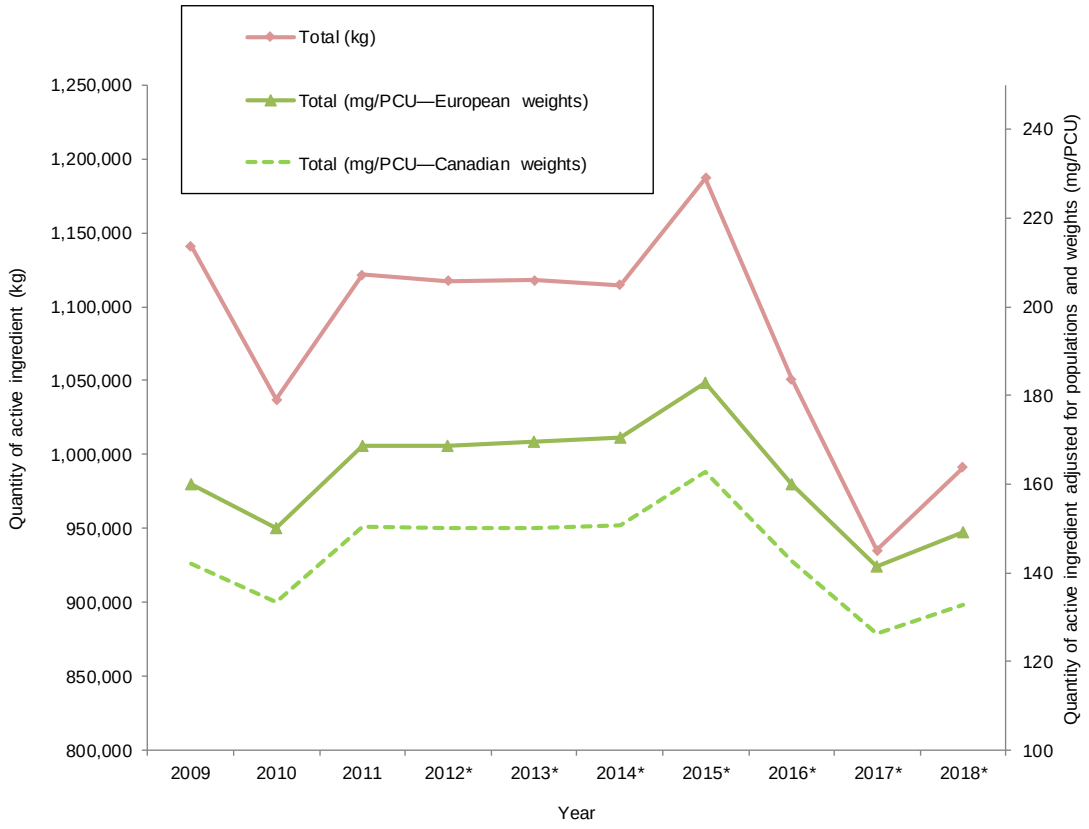
See corresponding footnotes on next page.

Figure 2. 7 Biomass as measured by the population correction unit (PCU in 1,000 tonnes) over time; using European Surveillance of Veterinary Antimicrobial Consumption production classes and European weights or proposed Canadian weights, 2009 to 2018 (continued)

The data used for live horses was from 2010; more recent data were unavailable at the time of writing.

Acknowledging the underlying sources of data structure the information differently, the PCU denominator was harmonized to the greatest extent possible with the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC)[3]. ESVAC denominator does not include beef cows, whereas in Canada beef cows are a significant population and are included in both figures.

Figure 2. 8 Antimicrobials distributed for sale for use in animals over time (kg of active ingredient and mg/PCU), 2009 to 2018



PCU = population correction unit.

The data used for live horses was from 2010; more recent data were unavailable at the time of writing.

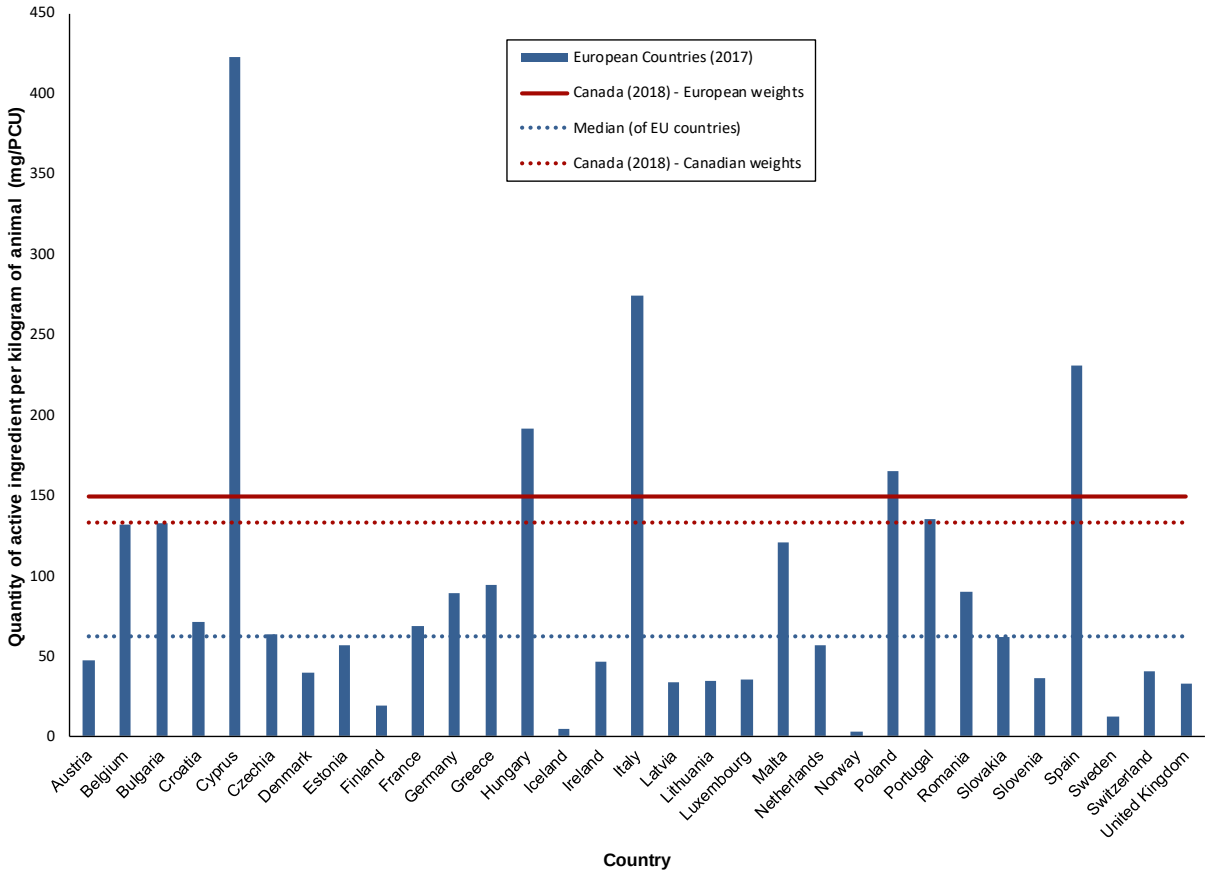
Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

* Indicates data excluded antimicrobials sold for use in companion animals.

[3] European Medicines Agency, European Surveillance of Veterinary Antimicrobial Consumption. ESVAC Population Correction Unit Template. Available at: http://www.ema.europa.eu/ema/index.jsp?curl=pages/regulation/document_listing/document_listing_000302.jsp. Accessed Oct. 11, 2017.

International data

Figure 2. 9 Sales of antimicrobials (adjusted by populations and weights) for Canada (2018) and countries participating in the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) network (2017)



PCU = population correction unit.

The Canadian data used for live horses was from 2010; more recent data were unavailable at the time of writing.

Animal distribution data do not include antimicrobials imported under the "own use" provision or importd as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

The PCU denominator was harmonized to the greatest extent possible with the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC)[4]. ESVAC denominator does not include beef cows, whereas in Canada beef cows are a significant population and are included. The ESVAC approach excludes companion animal data from the numerator.

[4] European Medicines Agency, European Surveillance of Veterinary Antimicrobial Consumption, 2019. 'Sales of veterinary antimicrobial agents in 31 European countries in 2017'. (EMA/294674/2019). Available at: https://www.ema.europa.eu/en/documents/report/sales-veterinary-antimicrobial-agents-31-european-countries-2017_en.pdf. Accessed October 17, 2019.

Antimicrobial distribution data and animal biomass: detailed denominator for population correction unit (PCU) over time

Table 2. 4 Detailed information on population numbers, 2018

Animal species	Animal class/production class	Production stage	Number of animals	ESVAC average weight at treatment or standard weight for import/export (kg)[a]	PCU_{ESVAC} (1,000 tonnes)	Canadian average weight at treatment or standard weight for import/export (kg)[a]	PCU_{CAN} (1,000 tonnes)
			n	w_1	$(n*w_1)/(1,000*1,000)$ (imports subtracted)	w_2	$(n*w_2)/(1,000*1,000)$ (imports subtracted)
Cattle							
	Cattle	Slaughter[b]	3,159,093				
	Cows [t]	Slaughter	529,986	425	225	578	306
	Heifers	Slaughter	933,314	200	187	200	187
	Steers and bulls	Slaughter	1,695,794	425	721	425	721
	Calves	Slaughter[b]	227,373	140	32	249	57
	Slaughter cattle and calves	Export for slaughter to the US[c]	427,522	425	182	425	182
	Calves	Live cattle and calf international import for feeding or slaughter[d]	-190,069	140	-27	249	-47
	Feeder cattle and calves	Export for feeding to US[c]	194,146	140	27	249	48
	Beef cows [t]	On farm[e]	3,674,800	425	1,562	520	1,912
	Dairy cows [t]	On farm[e]	972,300	425	413	635	617
	Total		8,465,165		3,322		3,982
Swine							
	Finishers	Slaughter[f]	21,401,418	65	1,391	65	1,391
	All swine	International import[g]	-3,400	65	0	65	0
	Swine	Export for feeding to US[c]	4,307,268	25	108	3[s]	13
	Swine	Export for slaughter to the US[c]	792,660	65	52	65	52
	Sows and gilts (6 months and over)	On farm[h]	1,240,400	240	298	240	298
	Total		27,738,346		1,848		1,753
Poultry							
	Chickens (categories < 1.4 kg, 1.4 and < 2.7 kg, >2.7 kg)	Slaughter[i]	730,039,980	1	730	1.2	876
	Turkey (categories < 6.2 kg, > 6.2 but not > 8.5 kg, > 8.5 kg but not > 10.8 kg, > 10.8 kg but not > 13.3 kg, > 13.3 kg, mature turkeys)	Slaughter[i]	20,210,579	6.5	131	6.5	131
	Poultry (< 185 g)	Live poutry for import[j]	-40,656,530	1	-41	0.2	-8
	Poultry (> 185 g)	Live poutry for import[j]	-85,241	1	0	2	0
	Poultry (< 185 g)	Export[j]	15,844,963	1	16	0.2	3
	Poultry (> 185 g)	Export[j]	2,139,252	1	2	2	4
	Total		727,493,003		839		1,007
Sheep and goats							
	Sheep and lamb	Slaughter[k]	704,000	20	14	20	14
	Goats	Slaughter[l]	80,420	20	2	20	2
	Sheep and lamb	International import[k]	-200	20	0	20	0
	Sheep and lamb	International export[c]	5,832	20	0	20	0
	Ewes	On farm[m]	512,900	75	38	75	38
	Total		1,302,952		54		54
Horses	Horses	Living[n]	963,500	400	385	500	482
Fish							
	Finfish	Production (kg)[o]	149,418,000	N/A	149	N/A	149
	Shellfish	Production (kg)[o]	41,841,000	N/A	42	N/A	42
	Total		191,259,000		191		191
Rabbits		Slaughter[p]	522,741	1.4	1	1.4	1
Total PCU production animals					**6,640**		**7,469**
Cats	N/A	N/A[q, r]	8,300,000	4	33.2	4	33
Dogs	N/A	N/A[q, r]	8,200,000	15	123	15	123
Total PCU companion animals					**156**		**156**

See corresponding footnotes on next pages.

Table 2. 4 Detailed information on population numbers, 2018 (continued)

For horses, data on number of horses on farm were only reported for 2006 and 2010.

N/A = Not applicable.

[a] As per European Surveillance of Veterinary Antimicrobial Consumption (ESVAC), unless otherwise specified. ESVAC does not include beef cows. Beef cows are included here because they are a significant animal population in Canada.

[b] Data from federal and provincial slaughter plants. Available at: http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?action=pR&pdctc=&r=105 and http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?action=pR&pdctc=&r=111. Accessed September 18, 2019. These data were parsed into various animal categories (cows, heifers, steers and bulls) according to the percentage of these animals slaughtered at the federal level. Available at: http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?action=pR&pdctc=&r=109. Accessed September 18, 2019. This makes the assumption that the percentages of each animal category slaughtered at the provincial level are the same as at the federal level.

[c] Cattle, swine, and sheep export numbers - for feeding and slaughter. Sheep export numbers for feeding and slaughter were combined as they have the same standard weight in ESVAC. Available at: http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?action=pR&pdctc=&r=191. Accessed September 18, 2019.

[d] Supply comparison by species between Canada and the United States. Table 3 Available at: http://www.agr.gc.ca/eng/industry-markets-and-trade/canadian-agri-food-sector-intelligence/red-meat-and-livestock/red-meat-and-livestock-market-information/supply-sheets-by-species/supply-comparison-by-species-between-canada-and-the-united-states/?id=1415860000063. Accessed September 18, 2019.

[e] Table 003-0032 On all cattle operations. Data for January 1st. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3210013001. Accessed September 18, 2019.

[f] Slaughtered pigs - federal and provincial. Available at: https://aimis-simia.agr.gc.ca/rp/index-eng.cfm?action=rR&promptLevel=2&pdctc=&r=53&debugcodes=0&p_71=128932&p_72=137777&report_format_type_code=45&p_60=WK&p_70=23094&btnNext=Next#wb-cont. Accessed: September 18, 2019.

[g] Added for Periods I and II. Statistics Canada. Hogs statistics, supply and disposition of hogs, semi-annual (x 1,000). Available at: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3210020001. Accessed September 18, 2019.

[h] Number of animals recorded for January 1 (Sows and gilts, 6 months and over). Statistics Canada. Table 32-10-0160-01 Hogs statistics, number of hogs on farms at end of semi-annual period (x 1,000). Available at: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3210016001. Accessed September 18, 2019.

[i] Live weight. For turkeys, mature birds were in a separate designated category and were included. Agriculture and Agri-Food Canada (Poultry Slaughter - Report 001). Available at: https://aimis-simia.agr.gc.ca/rp/index-eng.cfm?action=pR&pdctc=&r=1. Accessed September 18, 2019.

[j] Included all poultry - total live birds. Agriculture and Agri-Food Canada (Poultry and Egg Trade Balance Report). Available at: http://www.agr.gc.ca/eng/industry-markets-and-trade/canadian-agri-food-sector-intelligence/poultry-and-eggs/poultry-and-egg-market-information/imports-and-exports/statistics-canada-poultry-and-egg-trade-reports/?id=1384971854405. Accessed September 18, 2019.

[k] Statistics Canada. Table 32-10-0126-01 Hogs, sheep and lambs, farm and meat production (x 1,000). Available at: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3210012601. Accessed September 18, 2019.

[l] Added numbers from federally and provincially inspected establishments. Agriculture and Agri-Food Canada (Annual Goats Slaughtered in Federally and Provincially Inspected Establishments in Canada). Available at: http://www.agr.gc.ca/eng/industry-markets-and-trade/canadian-agri-food-sector-intelligence/red-meat-and-livestock/red-meat-and-livestock-market-information/slaughter/goat-slaughtered-in-canada/?id=1415860000044#2014. Accessed September 18, 2019.

[m] Number of animals recorded on January 1st. Statistics Canada. Table 32-10-0129-01 Number of sheep and lambs on farms (x 1,000). Available at: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3210012901. Accessed September 18, 2019.

Table 2. 4 Detailed information on population numbers, 2018 (continued)

[n] 2010 Canadian Equine Industry Profile Study. Available at: https://www.equestrian.ca/cdn/storage/resources_v2/wf9c32LH4uErLanMs/original/wf9c32LH4uErLanMs.pdf. Accessed September 18, 2019.

[o] Statistics Canada. Table 32-10-0107-01 Aquaculture, production and value. Available at: www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0030001&pattern=aquaculture&tabMode=dataTable&srchLan=-1&p1=1&p2=49. Accessed October 31, 2019.

[p] Federal and provincial slaughter. Available at: http://www.agr.gc.ca/eng/industry-markets-and-trade/canadian-agri-food-sector-intelligence/red-meat-and-livestock/red-meat-and-livestock-market-information/supply-sheets-by-species/rabbit-industry-at-a-glance/?id=1415860000120. Accessed September 18, 2019.

[q] Companion Animal Health. Canadian Animal Health Institute. Available at: https://www.cahi-icsa.ca/press-releases/latest-canadian-pet-population-figures-released. Accessed September 18, 2019.

[r] Average weights for cats and dogs from French Agency for Food, Environmental and Occupational Health & Safety (ANSES) - French Agency for Veterinary Medicinal Products (ANMV). Sales survey of Veterinary Medicinal Products containing Antimicrobials in France - 2014. Volumes and estimated exposure of animals to antimicrobials. Available at: https://www.anses.fr/en/system/files/ANMV-Ra-Antibiotiques2014EN.pdf. Accessed on May 24, 2016.

[s] Per 2015 and 2016 discussion with Québec swine expert the Canadian average weight of treatment of exported weaner pigs was changed to 3 kg.

[t] Per 2018 and 2019 discussions, the average Canadian weights of beef and dairy cows were updated. For beef cows, the new weight was based on the average mature beef cow 5 years and older in National Animal Health Monitoring System (NAHMS). Beef 2007–08 Part IV: Reference of Beef Cow-calf Management Practices in the United States, 2007–08. For dairy cows, the new weight was based on a 1400 lb mature cow as per an American Bovine Alliance on Management and Nutrition (BAMN) Publication Heifer Growth and Economics: Target Growth. This also resulted in a change to the average weight of cows slaughtered (it became the average weight of beef cows and dairy cows).

Table 2. 5 Quantity of ionophores and chemical coccidiostats (kg) distributed for sale for use in animals, 2009 to 2018

Antimicrobial class aggregation	Quantity of active ingredient (kg)										Change (%) from 2009 to 2018	Change (%) from 2017 to 2018
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		
Ionophores, chemical anticoccidials, and arsenicals[a]												
Ionophores, chemical coccidiostats, arsenicals, and nitroimidazoles[a]	491,152	490,355										
Chemical coccidiostats[a]			22,372									
				18,471								
					45,138	104,332	104,067	85,564				
									102,187	98,846	NA	-3%
Ionophores[a]			433,332									
				473,595								
					311,652	462,476	466,888	487,113	496,533	529,842	NA	7%
Total	**491,152**	**490,355**	**455,704**	**492,066**	**356,790**	**566,808**	**570,955**	**572,677**	**598,721**	**628,688**	**NA**	**5%**

NA = not available or not applicable.

Changes in percentage over time from 2009 to 2018 are relative to the quantities reported in 2009. Changes in percentage over time from 2017 to 2018 are relative to the quantities reported in 2017.

Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

CAHI provides the information according to a "3 company accounting rule" established by CAHI to comply with the European Union and the United States' anti-competition regulations. CAHI added in some cases a "90% rule" to be sure not to infringe the regulations in the United States. These accounting rules can result in changes to the categorization of specific antimicrobials over time; hence within an antimicrobial category, columns with different colours should not be compared.

Farm Surveillance in broiler chickens

Summary of antimicrobial use by routes of administration

Table 2. 6 Number of broiler flocks with reported antimicrobial use by route of administration, 2018

Antimicrobial use	Route of administration			
	Any route[a] n (%)	*In ovo* /subcutaneous n (%)	Feed n (%)	Water n (%)
Any antimicrobial use	110 (78)	25 (18)	106 (75)	14 (10)
No antimicrobial use[b]	31 (22)	116 (82)	35(25)	127 (90)
Total flocks	**141 (100)**	**141 (100)**	**141 (100)**	**141 (100)**

[a] Flocks with reported use of an antimicrobial class by feed, water, *in ovo*/subcutaneous, or any combination of these routes are included in each count.

[b] These were flocks not medicated with any of the antimicrobials listed in Table 2. 7 (next page).

Table 2. 7 Frequency and quantity of antimicrobial use in broiler chickens, 2018

Route of administration	Antimicrobial	Flocks n (%)	Ration n (%)	Days exposed median (min. ; max.)[a]	Level of drug median (min. ; max.)[b]	Quantity of antimicrobial active ingredient[c]	
						mg/PCU	nDDDvetCA/ 1,000 Broiler chicken-days at risk
Feed					g/tonne		
II	Tylosin	20 (14)	56 (11)	7 (2 ; 16)	22 (22 ; 22)	5	6
	Penicillin G procaine	21 (15)	46 (9)	8 (4 : 14)	55 (31 ; 110)	20	110
	Virginiamycin	22 (16)	51 (10)	8 (1 ; 18)	22 (11 ;22)	6	63
	Trimethoprim sulfadiazine	6 (4)	9 (2)	4 (1 ; 9)	300 (200 ; 300)	11	49
III	Bacitracin	67 (48)	189 (36)	9 (1 ; 28)	55 (55 ; 110)	65	190
	Oxytetracycline	2 (1)	2 (< 1)	9 (7 ; 10)	440 (440 ; 440)	4	7
IV	Bambermycin	2 (1)	8 (2)	8 (5 ; 11)	2 (2 ; 2)	0.1	
N/A	Avilamycin	21 (15)	40 (8)	9 (3 ; 15)	20 (15 ;30)	6	58
	No AMU in feed	35 (25)	127 (24)				
Total feed, medicated		**113 (80)**	**401 (76)**			**116**	**483**
Water			**Treatment (n)**		**g/Liter (median)**		
I	Enrofloxacin	1 (1)	1	4 (4 ; 4)	< 0.01	< 0.1	< 0.1
II	Amoxicillin	3 (2)	3	5 (5 ;5)	0.02	0.4	1
	Lincomycin	1 (1	1	4 (3 ; 5)	0.16	0.2	1
	Penicillin	1 (1)	1	4 (4 ; 4)	0.92	6.1	4.4
	Penicillin-streptomycin	4 (3)	4	4 (3 ; 5)	0.11	0.6	1
III	Sulfamethazine	1 (1)	1	3 (3 ; 3)	0.98	1	0.1
	Tetracycline-neomycin	1 (1)	1	4 (5 ; 5)	0.45	1.2	1.6
	No AMU in water	127 (90)					
Total water, medicated		**14 (10)**	**12**			**9**	**10**
Injection					**mg/egg or chick**		
II	Gentamicin	2 (1)			0.2	< 0.1	0.01
	Lincomycin-spectinomycin	18 (13)			0.75	0.2	0.5
	No AMU via injection	**116 (82)**				0.16	
Total injection		**20 (14)**				**0.2**	**0.5**
All routes[d]		**106 (75)**				**126**	**493**

See corresponding page for footnotes.

Table 2. 7 Frequency and quantity of antimicrobial use in broiler chickens, 2018 (continued)

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

N/A = not applicable (no classification available at the time of writing of this report).

ESVAC = European Surveillance of Veterinary Antimicrobial Consumption.

AMU = antimicrobial use.

Combination antimicrobials include the values for both antimicrobial components.

Grey shaded cells = no data or calculations/values are not applicable for broilers.

mg/PCU = milligrams/population correction unit.

DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligrams per kilogram broiler chicken per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

nDDDvetCA/1,000 broiler chicken-days at risk = number of DDDvetCA/1,000 broiler chicken-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

[a] Days exposed are by ration (not full grow-out) or 1 course of water treatment.

[b] Level of drug is in grams/tonne of feed or grams/liter drinking water. In water, "grams" is the inclusion rate multiplied by the concentration of the drug in that product. In chicks or hatching eggs, level of drug is in milligrams per chick or hatching egg, as reported by the veterinarian/producer.

[c] Total quantity of antimicrobials were calculated based on feed or water consumed (feed and water were estimated based on breed standards).

[d] The final mg/PCU and nDDDvetCA/1,000 broiler chicken-days at risk exclude coccidiostats. Flavophospholipids was included only in the mg/PCU.

Table 2. 8 Production, biomass and quantity of antimicrobials used by province/region, 2014 to 2018

Province/ region	Year	Number of flocks	Pre-harvest weight	Age sampled	Active ingredient	Broiler weights	mg/PCU		nDDDvetCA/1,000 broiler chicken-days at risk	
			mean (kg)	mean (days)	(mg)	(kg)[a]	Total	%change[b]	Total	%change[b]
British Columbia	2014	29	1.9	33	67,614,063	650,756	104		380	
	2015	25	2.0	33	54,624,132	592,652	92	-11	403	6
	2016	32	2.0	33	73,638,017	765,987	96	4	493	22
	2017	30	2.0	34	72,240,003	732,417	99	3	431	-13
	2018	30	1.9	33	119,718,451	1,048,356	114	16	549	28
Prairies	2014	37	1.9	34	153,610,926	910,594	169		448	
	2015	38	1.9	34	95,949,044	746,106	129	-24	424	-5
	2016	38	1.9	34	137,537,699	857,215	160	25	606	43
	2017	38	1.9	34	123,570,847	790,810	156	-3	561	-7
	2018	44	2.0	34	145,557,865	1,115,016	131	-16	420	-25
Ontario	2014	42	2.2	36	172,601,948	999,661	173		630	
	2015	49	2.4	38	228,041,059	1,204,851	189	10	679	8
	2016	40	2.2	36	111,939,019	884,702	127	-33	603	-11
	2017	39	2.3	36	140,657,325	987,244	142	13	613	2
	2018	40	2.3	36	135,093,591	937,408	144	1	512	-17
Québec	2014	33	2.0	33	110,056,642	739,406	149		594	
	2015	23	1.8	33	69,081,483	491,834	140	-6	470	-21
	2016	26	1.9	33	72,813,677	544,595	134	-5	599	28
	2017	30	1.9	32	70,767,692	702,314	101	-25	470	-21
	2018	27	1.9	33	69,077,509	631,377	109	9	498	6
National[c]	2014	141	2.0	34	424,631,048	3,300,417	153		524	
	2015	135	2.1	35	403,955,939	3,035,442	147	-3	535	2
	2016	136	2.0	34	378,633,975	3,052,498	130	-12	576	8
	2017	137	2.0	34	384,264,405	3,212,784	127	-2	529	-8
	2018	141	2.0	34	434,662,953	3,732,157	126	-1	493	-7

Some values presented in this report slightly differ from the previous year's reports due to flock size corrections, improvement to the database and methodology refinements.

mg/PCU = milligrams/population correction unit.

ESVAC = European Surveillance of Veterinary Antimicrobial Consumption.

DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligrams per kilogram broiler chicken per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

nDDDvetCA/1,000 broiler chicken-days at risk = number of DDDvetCA/1,000 broiler chicken-days at risk.

For detailed indicator descriptions, please refer to the 2018 CIPARS: Design and methods document.

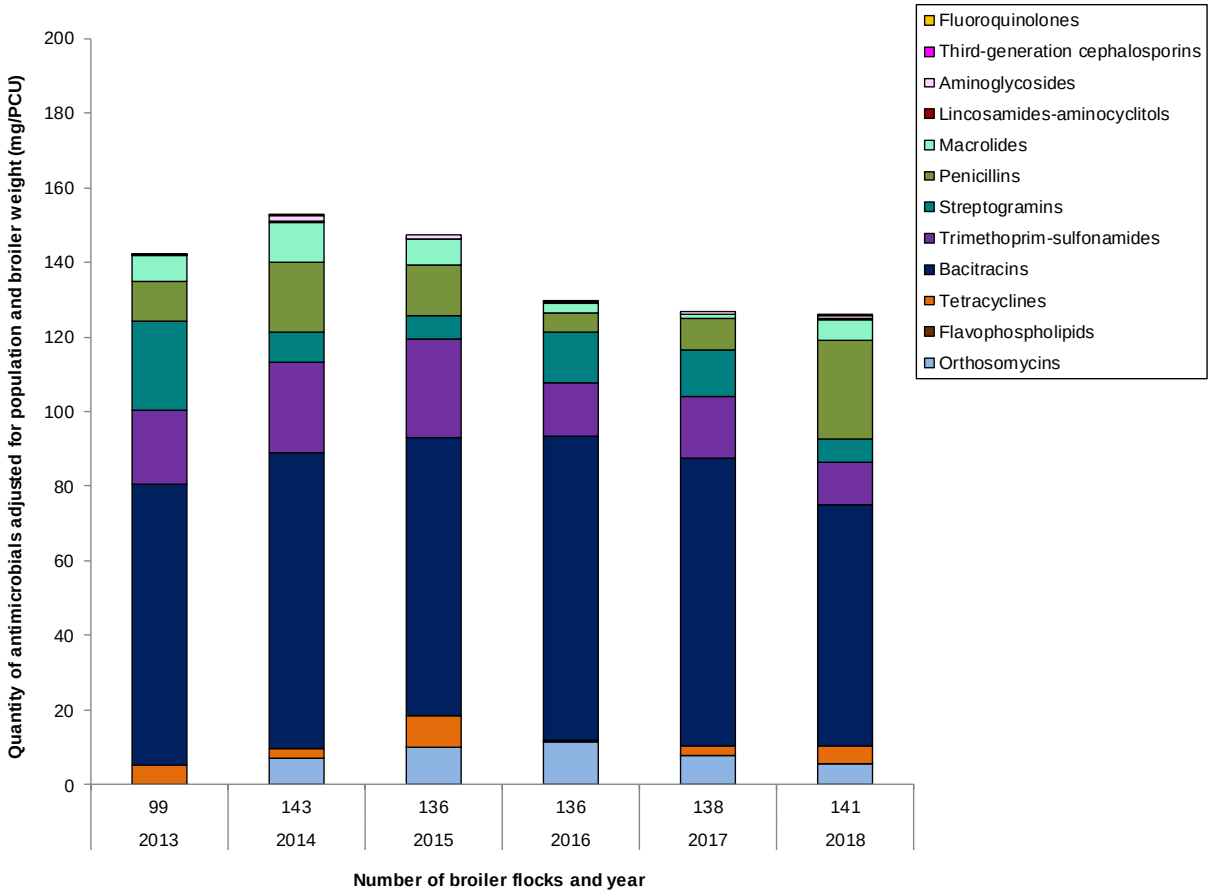
The Prairies is a region including the provinces of Alberta and Saskatchewan.

[a] Population correction unit (PCU) or biomass, European weight (total flock population x ESVAC standard weight of 1 kg bird).

[b] Percent change = [(current surveillance year – previous surveillance year)/previous surveillance year] x 100.

[c] Includes only the provinces/regions surveyed and combines the quantity of antimicrobials used in feed, water and injection excluding coccidiostats, antiprotozoals and flavophospholipids.

Figure 2. 10 Quantity of antimicrobial use in all routes of administration, adjusted for population and broiler weight (mg/PCU), 2013 to 2018



Year Number of flocks		2013 99	2014 143	2015 136	2016 136	2017 138	2018 141
Antimicrobial class							
I	Fluoroquinolones	< 0.1	0	0	0	0	< 0.1
	Third-generation cephalosporins	< 0.1	< 0.1	0	0	0	0
II	Aminoglycosides	< 0.1	2	1	0.5	1	1
	Lincosamides-aminocyclitols	0.1	0.1	0.2	0.1	0.1	0.3
	Macrolides	7	11	7	3	1	5
	Penicillins	11	19	14	5	8	27
	Streptogramins	24	8	6	14	13	6
	Trimethoprim and sulfonamides	20	24	26	14	16	11
III	Bacitracins	75	79	74	82	77	65
	Tetracyclines	5	3	8	0	2	5
IV	Flavophospholipids	0.2	0	0.3	< 0.1	0.1	0.1
N/A	Orthosomycins	0	7	10	11	8	6
Total		**142**	**153**	**147**	**130**	**127**	**126**

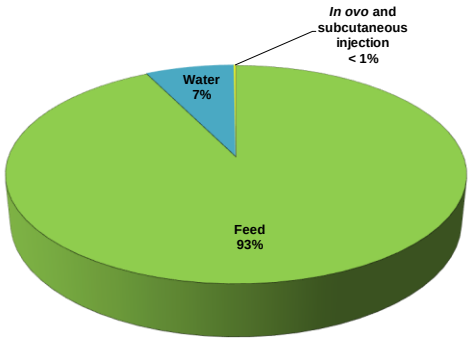
Roman numerals I to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).

mg/PCU = milligrams/population correction unit.

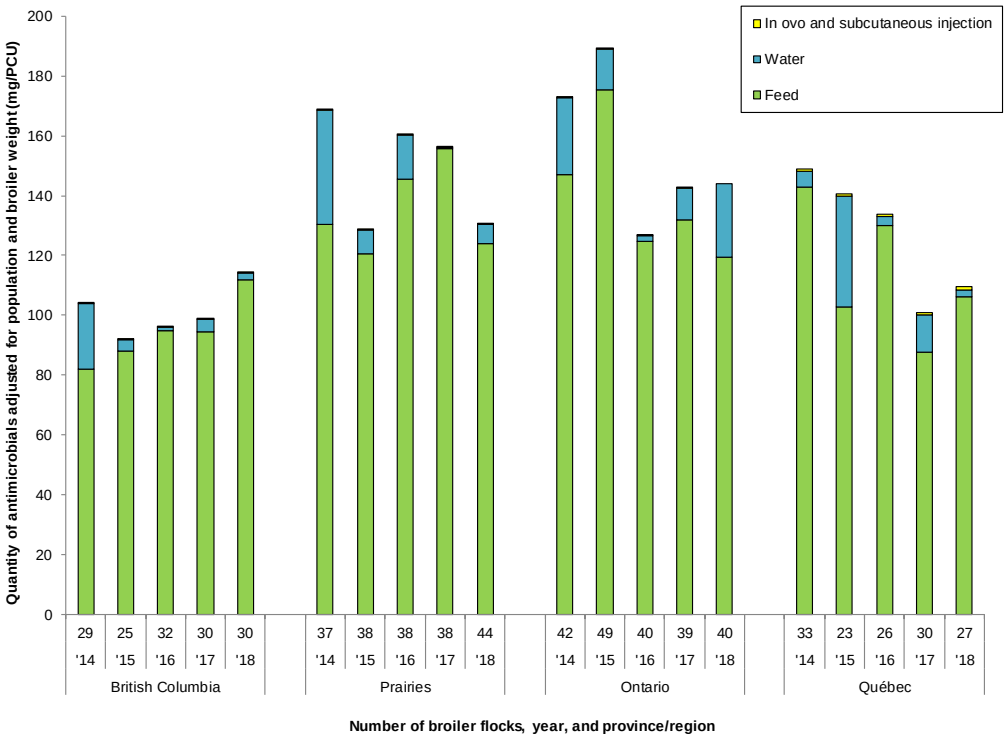
For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Figure 2. 11 Quantity of antimicrobials, adjusted for population and broiler weight (mg/PCU), in 2018 and by province/region, 2014 to 2018

a) 2018



b) by province/region



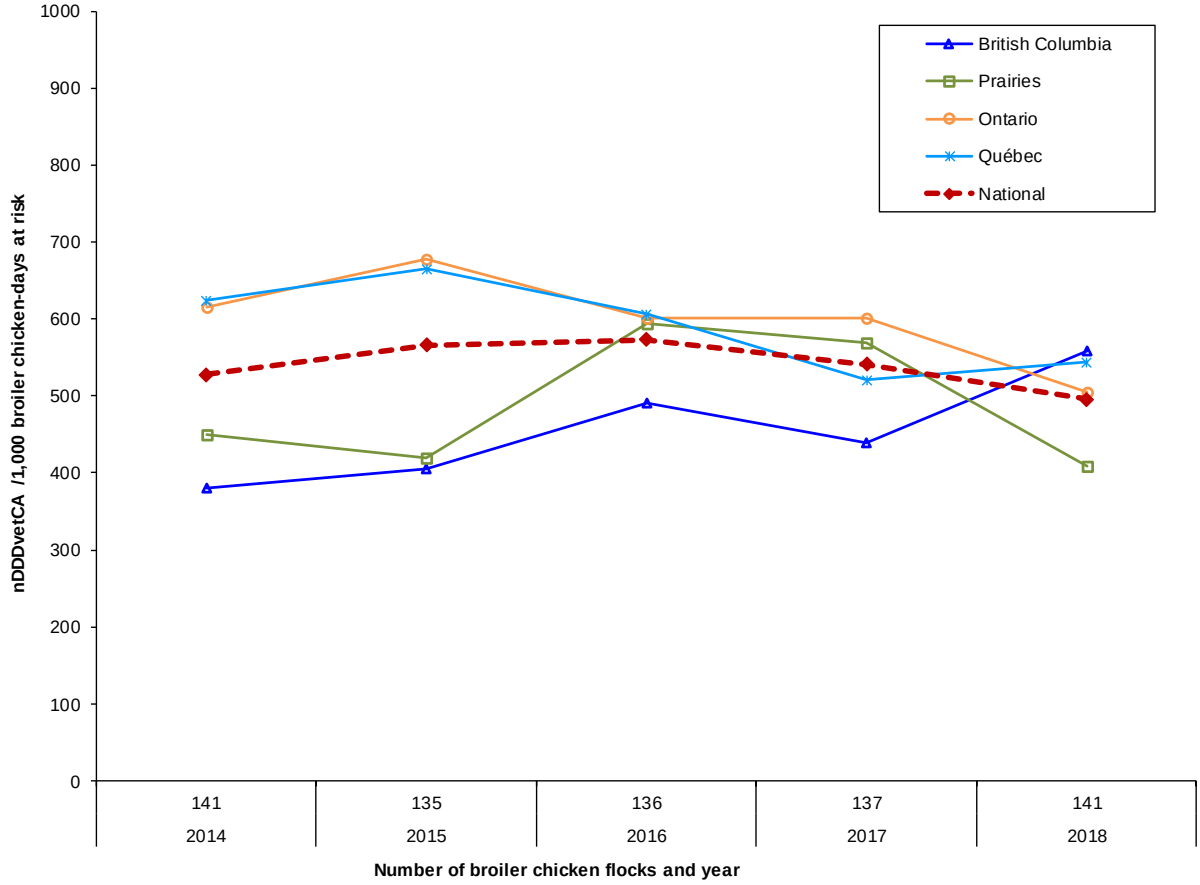
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks	29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Route of administration																				
Feed	82	88	95	94	112	130	120	146	156	124	147	176	125	132	119	143	103	130	88	106
Water	22	4	1	4	2	38	8	15	0	7	26	13	2	10	25	5	37	3	13	2
In ovo and subcutaneous injection	0.1	0.3	0.03	0.1	0.02	0.03	0.1	0.04	0.1	0.04	0.1	0.2	0.05	0.03	0	0.6	0.6	0.7	0.5	0.9
Total	**104**	**92**	**96**	**99**	**114**	**169**	**129**	**160**	**156**	**131**	**173**	**189**	**127**	**142**	**144**	**149**	**140**	**134**	**101**	**109**

See corresponding footnotes on next page.

Figure 2. 11 Quantity of antimicrobials, adjusted for population and broiler weight (mg/PCU), in 2018 and by province/region, 2014 to 2018 (continued)

mg/PCU = milligrams/population correction unit.
For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 2. 12 Number of Canadian Defined Daily Doses for animals per 1,000 broiler chicken-days at risk (nDDDvetCA/1,000 broiler chicken-days at risk) for all routes of administration by province/region, 2013 to 2018



Year Number of flocks	2014 95	2015 85	2016 91	2017 82	2018 97
Province/region					
Prairies	308	268	217	177	193
Ontario	294	325	200	259	192
Québec	255	268	164	130	94
National	**290**	**281**	**202**	**178**	**171**

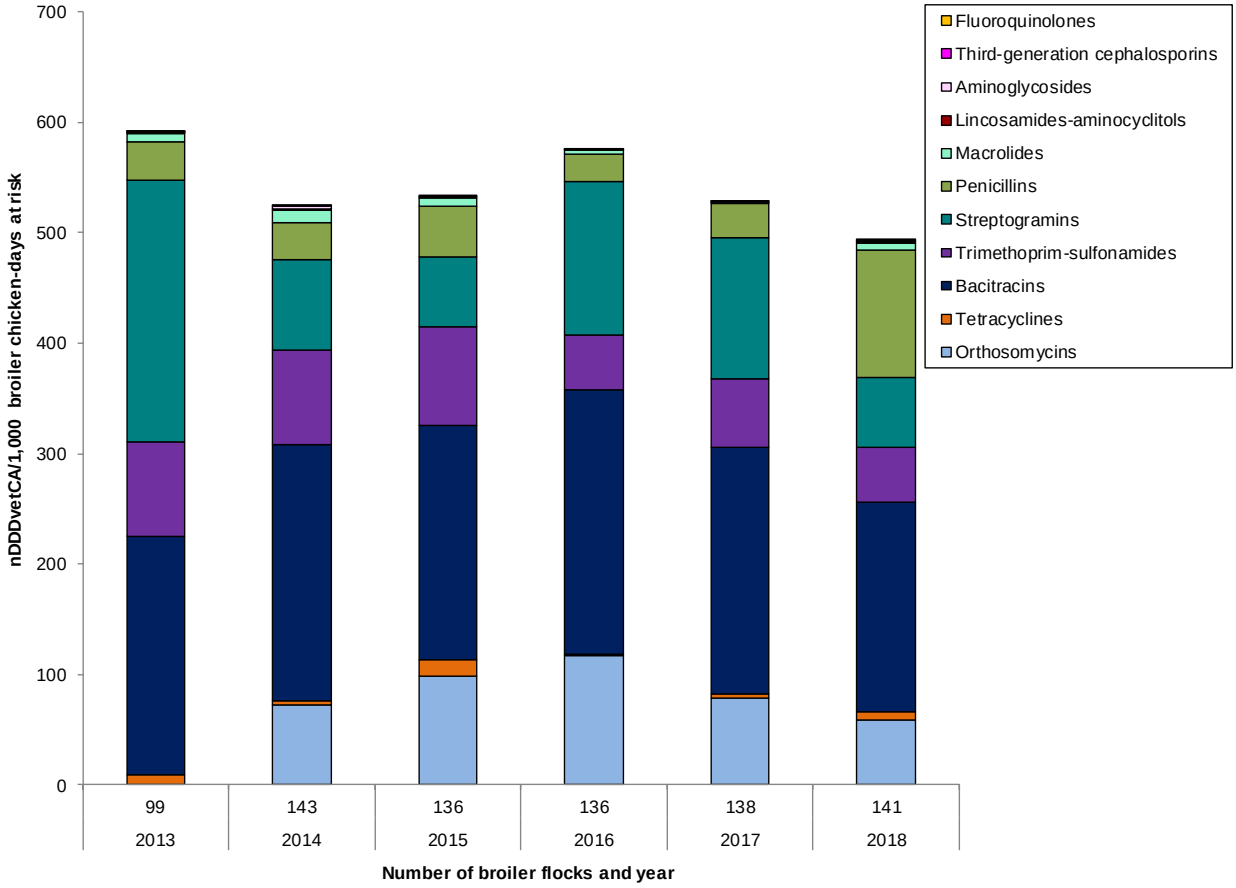
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

nDDDvetCA/1,000 broiler chicken-days at risk = Number of DDDvetCA/1,000 broiler chicken-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 2. 13 Number of Canadian Defined Daily Doses for animals per 1,000 broiler chicken-days at risk (nDDDvetCA/1,000 broiler chicken-days at risk) for all routes of administration, 2013 to 2018



Year		2013	2014	2015	2016	2017	2018
Number of flocks		99	143	136	136	138	141
Antimicrobial class							
I	Fluoroquinolones	< 0.1	0	0	0	0	< 0.1
	Third-generation cephalosporins	1	0.1	0	0	0	0
II	Aminoglycosides	< 0.1	2	2	1	1	1
	Lincosamides-aminocyclitols	1	1	1	0.5	0.5	2
	Macrolides	8	12	7	3	1	6
	Penicillins	34	33	47	25	31	116
	Streptogramins	237	83	63	139	128	63
	Trimethoprim and sulfonamides	85	85	89	50	61	49
III	Bacitracins	217	232	213	239	224	190
	Tetracyclines	9	4	15	1	4	8
N/A	Orthosomycins	0	72	98	117	79	58
Total		**591**	**524**	**535**	**576**	**529**	**493**

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).

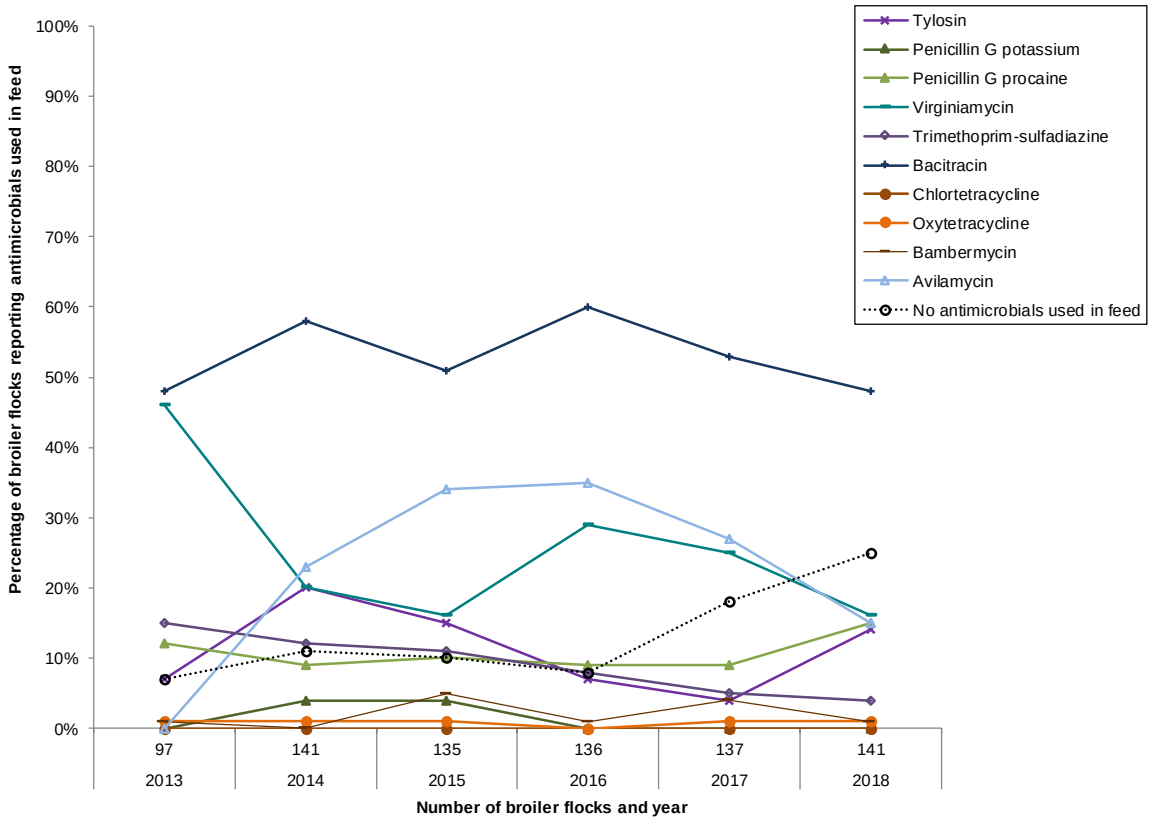
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

nDDDvetCA/1,000 broiler chicken-days at risk = Number of DDDvetCA/1,000 broiler chicken-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Antimicrobial use in feed by frequency

Figure 2. 14 Percentage of broiler flocks reporting antimicrobial use in feed, 2013 to 2018



Year		2013	2014	2015	2016	2017	2018
Number of flocks		97	141	135	136	137	141
Antimicrobial							
II	Tylosin	7%	20%	15%	7%	4%	14%
	Penicillin G potassium	0%	4%	4%	0%	0%	0%
	Penicillin G procaine	12%	9%	10%	9%	9%	15%
	Virginiamycin	46%	20%	16%	29%	25%	16%
	Trimethoprim-sulfadiazine	15%	12%	11%	8%	5%	4%
III	Bacitracin	48%	58%	51%	60%	53%	48%
	Chlortetracycline	0%	0%	0%	0%	0%	0%
	Oxytetracycline	1%	1%	1%	0%	1%	1%
IV	Bambermycin	1%	0%	5%	1%	4%	1%
N/A	Avilamycin	0%	23%	34%	35%	27%	15%
	No antimicrobials used in feed	7%	11%	10%	8%	18%	25%

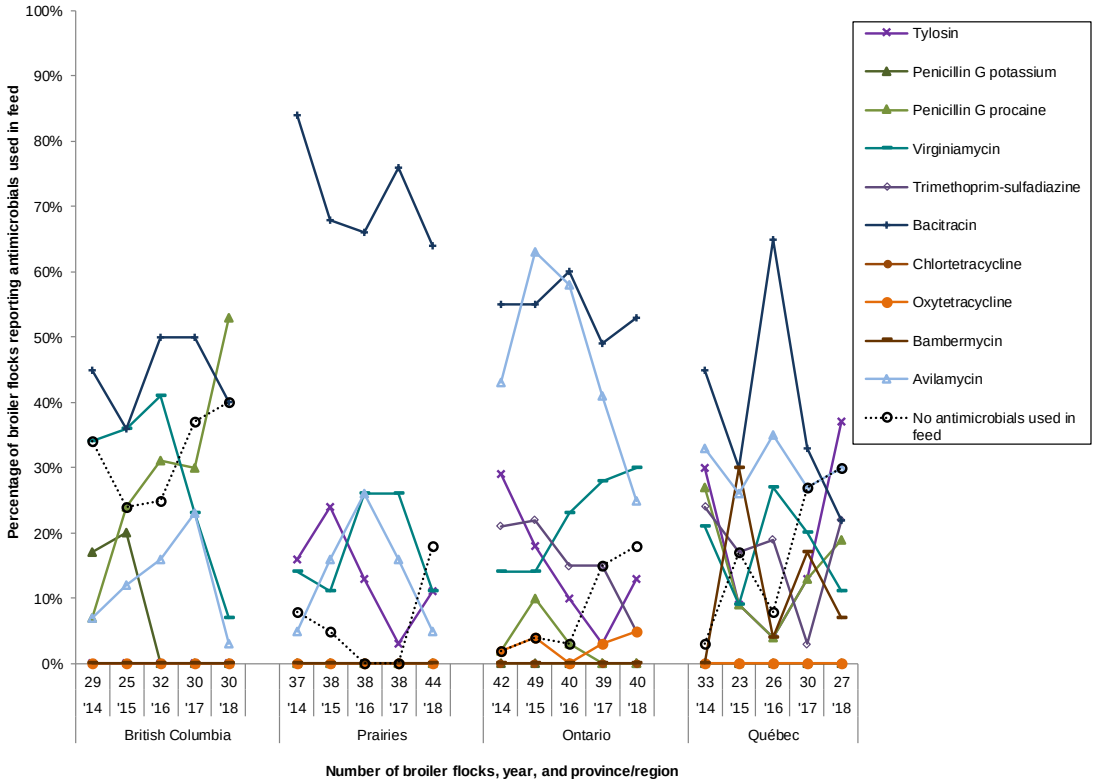
Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).

Numbers per column may not add up to 100% as some flocks may have used an antimicrobial more than once or used multiple antimicrobials throughout the grow-out period.

For the temporal analyses, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.

Please note that the "no antimicrobials used" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories II to IV and avilamycin).

Figure 2. 15 Percentage of broiler flocks reporting antimicrobial use in feed by province/region, 2014 to 2018



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Antimicrobial																					
	Tylosin	0%	0%	0%	0%	0%	16%	24%	13%	3%	11%	29%	18%	10%	3%	13%	30%	9%	4%	13%	37%
	Penicillin G potassium	17%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
II	Penicillin G procaine	7%	24%	31%	30%	53%	0%	0%	0%	0%	0%	2%	10%	3%	0%	0%	27%	9%	4%	13%	19%
	Virginiamycin	34%	36%	41%	23%	7%	14%	11%	26%	26%	11%	14%	14%	23%	28%	30%	21%	9%	27%	20%	11%
	Trimethoprim-sulfadiazine	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	21%	22%	15%	15%	5%	24%	17%	19%	3%	22%
	Bacitracin	45%	36%	50%	50%	40%	84%	68%	66%	76%	64%	55%	55%	60%	49%	53%	45%	30%	65%	33%	22%
III	Chlortetracycline	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Oxytetracycline	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	4%	0%	3%	5%	0%	0%	0%	0%	0%
IV	Bambermycin	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	30%	4%	17%	7%
NA	Avilamycin	7%	12%	16%	23%	3%	5%	16%	26%	16%	5%	43%	63%	58%	41%	25%	33%	26%	35%	27%	30%
	No antimicrobials used in feed	34%	24%	25%	37%	40%	8%	5%	0%	0%	18%	2%	4%	3%	15%	18%	3%	17%	8%	27%	30%

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).

Numbers per column may not add up to 100% as some flocks may have used an antimicrobial more than once or used multiple antimicrobials throughout the grow-out period.

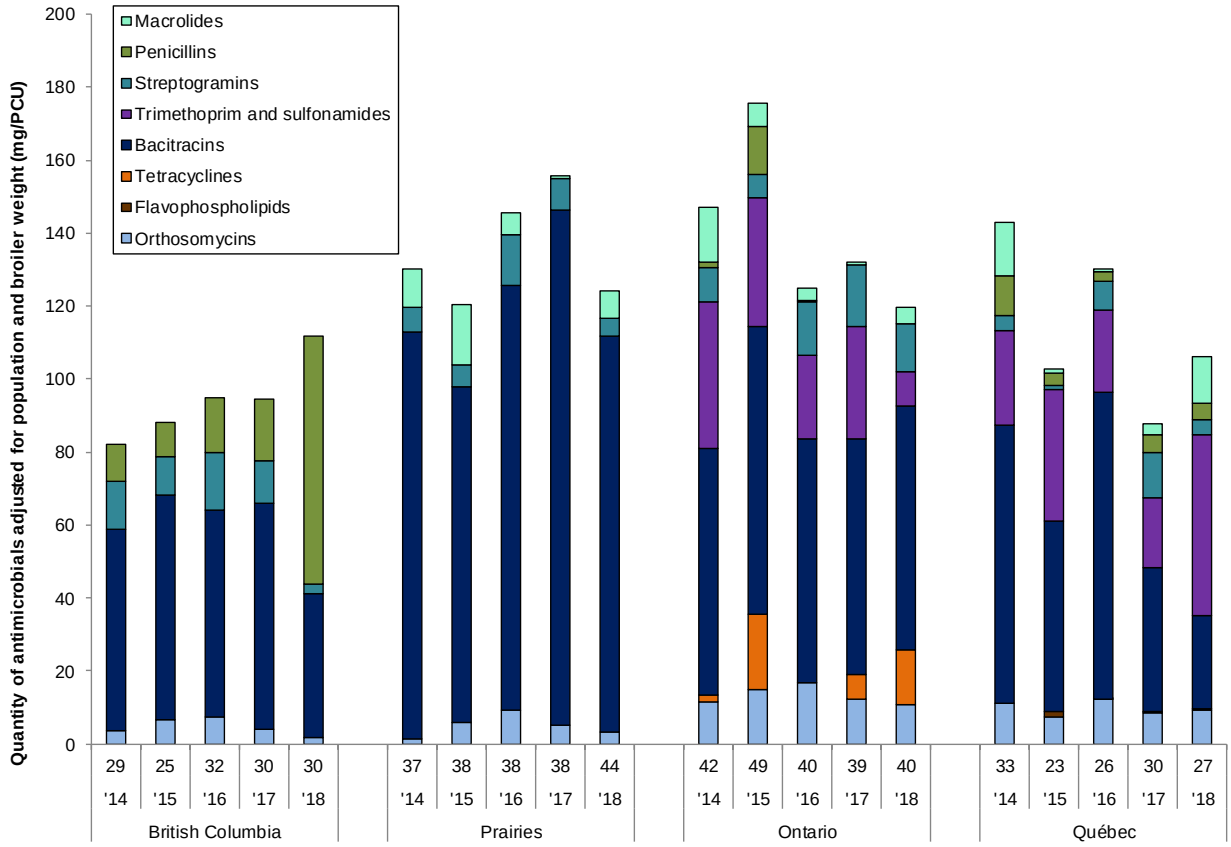
For the temporal analyses within province/region, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province/region ($P \leq 0.05$) for a given antimicrobial. The presence of red areas indicates significant provincial/regional differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given antimicrobial.

Please note that the "no antimicrobials used" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories II to IV and avilamycin), some flocks have used coccidiostats; previous years' data were updated.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Antimicrobials use in feed by quantitative indicators

Figure 2. 16 Quantity of antimicrobial use in feed adjusted for population and broiler weight (mg/PCU), 2014 to 2018



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks	29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Antimicrobial class																				
II Macrolides	0	0	0	0	0	11	17	6	1	7	15	6	3	1	4	15	1	1	3	13
II Penicillins	10	9	15	17	68	0	0	0	0	0	2	13	0	0	0	11	4	3	5	5
II Streptogramins	13	11	15	12	3	7	6	14	9	5	9	7	15	17	13	4	1	8	12	4
II Trimethoprim and sulfonamides	0	0	0	0	0	0	0	0	0	0	40	35	23	31	9	26	36	23	19	50
III Bacitracins	55	62	57	62	39	112	92	116	141	109	68	79	67	65	67	76	52	84	39	25
III Tetracyclines	0	0	0	0	0	0	0	0	0	0	2	20	0	7	15	0	0	0	0	0
IV Flavophospholipids	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0
N/A Orthosomycins	4	7	7	4	2	1	6	9	5	3	11	15	17	12	11	11	7	12	8	9
Total	**82**	**88**	**95**	**94**	**112**	**130**	**120**	**146**	**156**	**124**	**147**	**176**	**125**	**132**	**119**	**143**	**103**	**130**	**88**	**106**

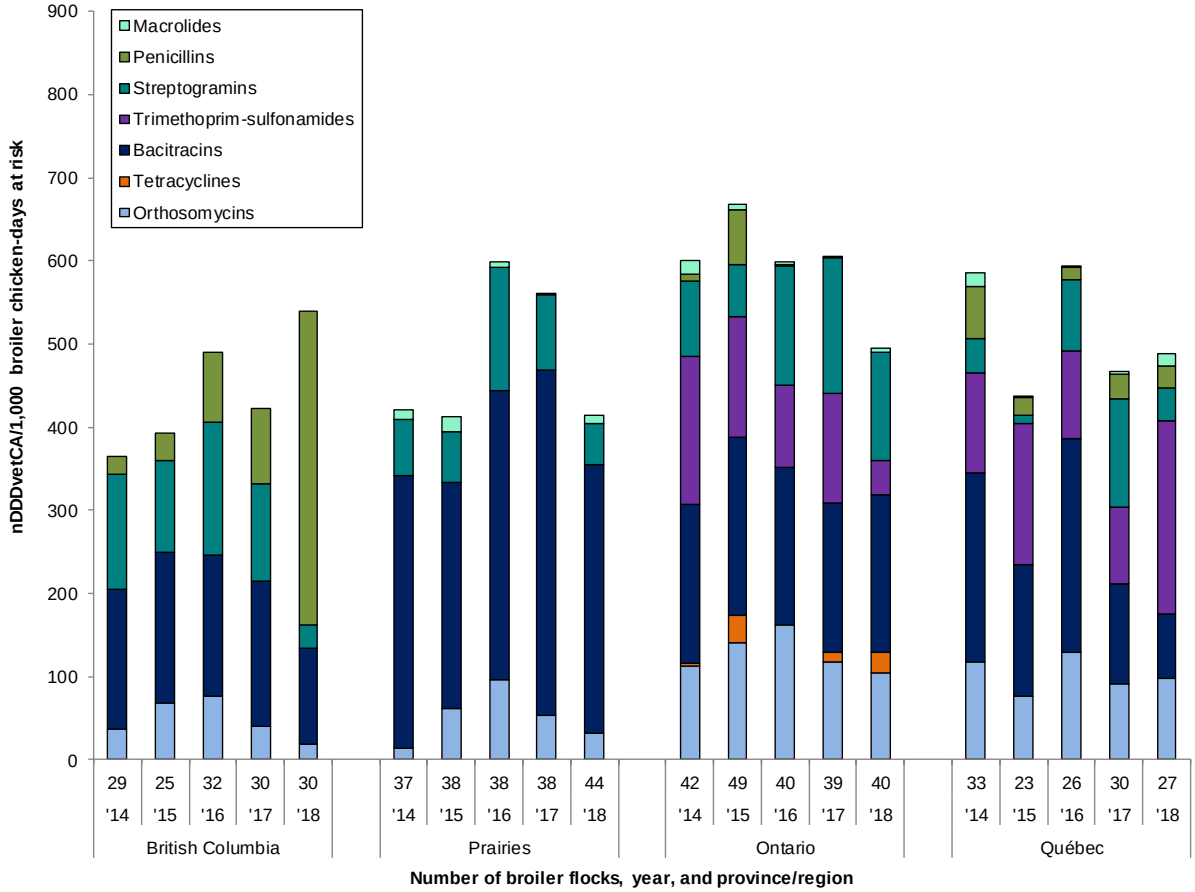
Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 2. 17 Number of Canadian Defined Daily Doses for animals per 1,000 broiler chicken-days at risk (nDDDvetCA/1,000 broiler chicken-days at risk) for antimicrobials administered in feed, 2014 to 2018



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Antimicrobial class																					
II	Macrolides	0	0	0	0	0	12	19	7	1	9	17	7	4	1	5	17	1	1	3	15
	Penicillins	20	33	84	90	377	0	0	0	0	0	8	66	2	0	0	62	20	14	30	26
	Streptogramins	139	109	161	116	28	68	60	148	91	50	91	62	143	163	131	41	10	86	130	41
	Trimethoprim and sulfonamides	0	0	0	0	0	0	0	0	0	0	177	146	100	132	40	120	171	107	92	232
III	Bacitracins	167	182	169	176	116	327	273	348	415	323	192	213	188	179	189	229	158	257	121	77
	Tetracyclines	0	0	0	0	0	0	0	0	0	0	3	33	0	12	26	0	0	0	0	0
N/A	Orthosomycins	38	68	77	40	19	14	61	96	53	32	113	141	163	118	104	117	77	129	91	98
Total		**365**	**393**	**490**	**422**	**540**	**421**	**413**	**599**	**560**	**414**	**601**	**668**	**600**	**604**	**494**	**586**	**436**	**593**	**467**	**489**

Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).

DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

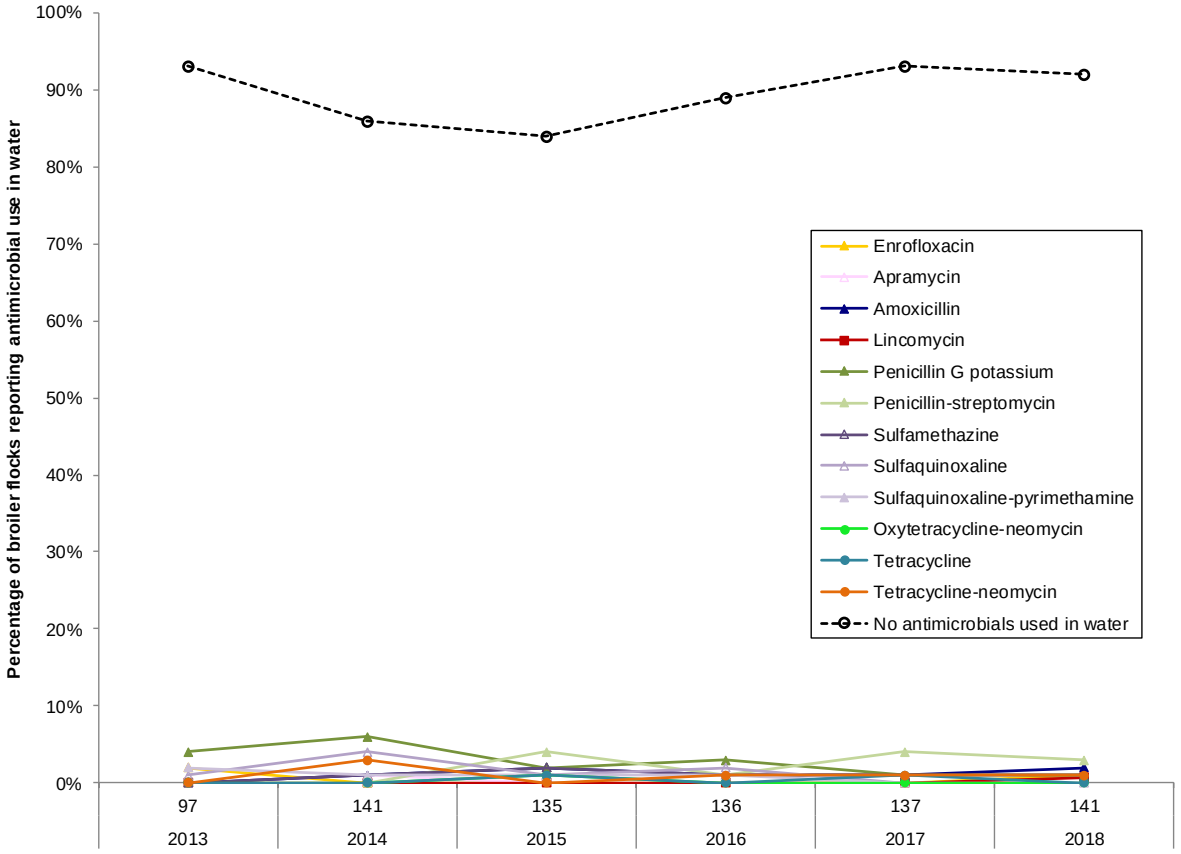
nDDDvetCA/1,000 broiler chicken-days at risk = number of DDDvetCA/1,000 broiler chicken-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Antimicrobial use in water by frequency

Figure 2. 18 Percentage of broiler flocks reporting antimicrobial use in water, 2014 to 2018



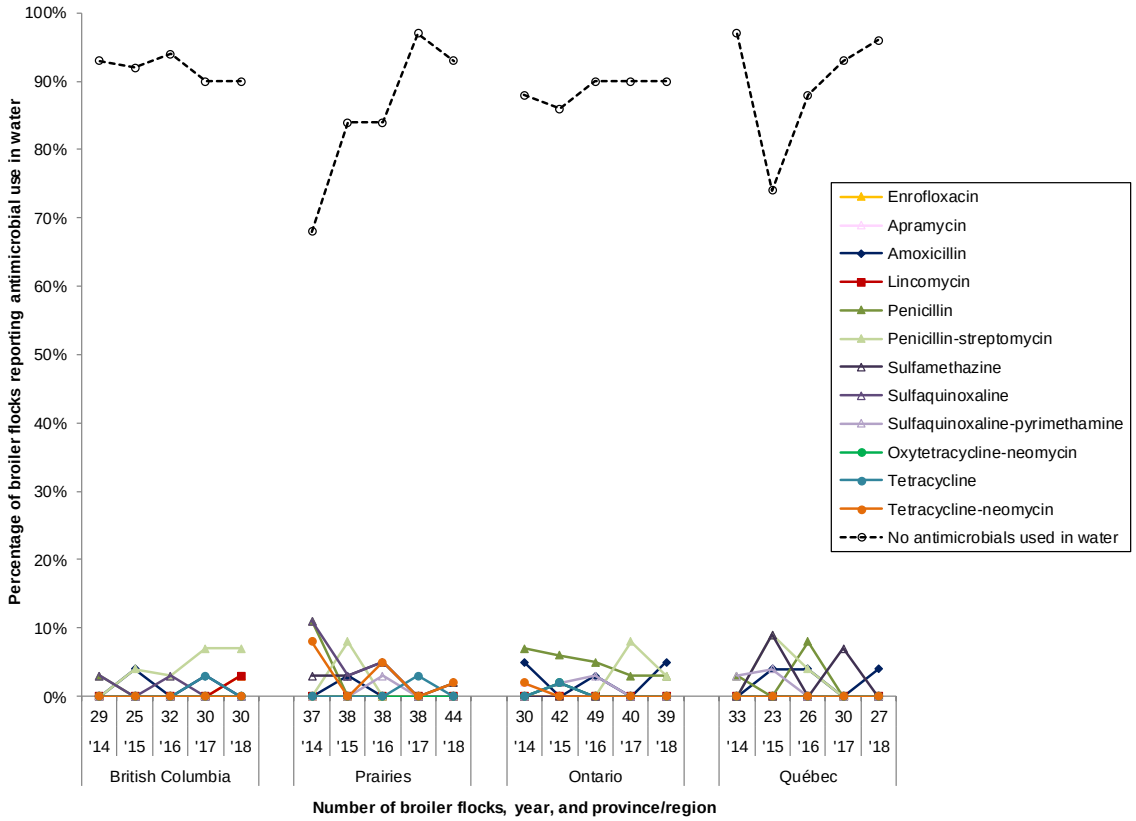
Year		2013	2014	2015	2016	2017	2018
Number of flocks		97	141	135	136	137	141
Antimicrobial							
I	Enrofloxacin	**2%**	0%	0%	0%	**0%**	**1%**
II	Apramycin	**0%**	1%	0%	0%	**0%**	**0%**
	Amoxicillin	**0%**	1%	2%	1%	**1%**	**2%**
	Lincomycin	**0%**	0%	0%	0%	**0%**	**1%**
	Penicillin G potassium	**4%**	6%	2%	3%	**1%**	**1%**
	Penicillin-streptomycin	**0%**	0%	4%	1%	**4%**	**3%**
III	Sulfamethazine	**0%**	1%	2%	1%	**1%**	**1%**
	Sulfaquinoxaline	**1%**	4%	1%	2%	**0%**	**0%**
	Sulfaquinoxaline-pyrimethamine	**2%**	1%	1%	1%	**0%**	**0%**
	Oxytetracycline-neomycin	**0%**	0%	1%	0%	**0%**	**0%**
	Tetracycline	**0%**	0%	1%	0%	**1%**	**0%**
	Tetracycline-neomycin	**0%**	3%	0%	1%	**1%**	**1%**
	No antimicrobials used in water	**93%**	86%	84%	89%	**93%**	**92%**

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

Numbers per column may not add up to 100% as some flocks have used an antimicrobial more than once or used multiple antimicrobials throughout the growing period.

For the temporal analyses, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in the first and previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.

Figure 2. 19 Percentage of broiler flocks reporting antimicrobial use in water by province/region, 2014 to 2018



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Antimicrobial																					
I	Enrofloxacin	**0%**	0%	0%	**0%**	**3%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
	Apramycin	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**2%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
	Amoxicillin	**0%**	4%	0%	**3%**	**0%**	**0%**	3%	0%	**0%**	**0%**	**5%**	0%	3%	**0%**	**5%**	**0%**	4%	4%	**0%**	**4%**
	Lincomycin	**0%**	0%	0%	**0%**	**3%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
	Penicillin G potassium	**3%**	0%	0%	**0%**	**0%**	**11%**	0%	0%	**0%**	**0%**	**7%**	6%	5%	**3%**	**3%**	**3%**	0%	8%	**0%**	**0%**
	Penicillin-streptomycin	**0%**	4%	3%	**7%**	**7%**	**0%**	8%	0%	**0%**	**2%**	**0%**	0%	0%	**8%**	**3%**	**0%**	9%	4%	**0%**	**0%**
III	Sulfamethazine	**0%**	0%	0%	**0%**	**0%**	**3%**	3%	5%	**0%**	**2%**	**0%**	0%	0%	**0%**	**0%**	**0%**	9%	0%	**7%**	**0%**
	Sulfaquinoxaline	**3%**	0%	3%	**0%**	**0%**	**11%**	3%	5%	**0%**	**0%**	**0%**	2%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
	Sulfaquinoxaline-pyrimethamine	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	3%	**0%**	**0%**	**0%**	2%	3%	**0%**	**0%**	**3%**	4%	0%	**0%**	**0%**
IV	Oxytetracycline-neomycin	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	2%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
	Tetracycline	**0%**	0%	0%	**3%**	**0%**	**0%**	0%	0%	**3%**	**0%**	**0%**	2%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
	Tetracycline-neomycin	**0%**	0%	0%	**0%**	**0%**	**8%**	0%	5%	**0%**	**2%**	**2%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
	No antimicrobials used in water	**93%**	92%	94%	**90%**	**90%**	**68%**	84%	84%	**97%**	**93%**	**88%**	86%	90%	**90%**	**90%**	**97%**	74%	88%	**93%**	**96%**

Roman numerals I to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

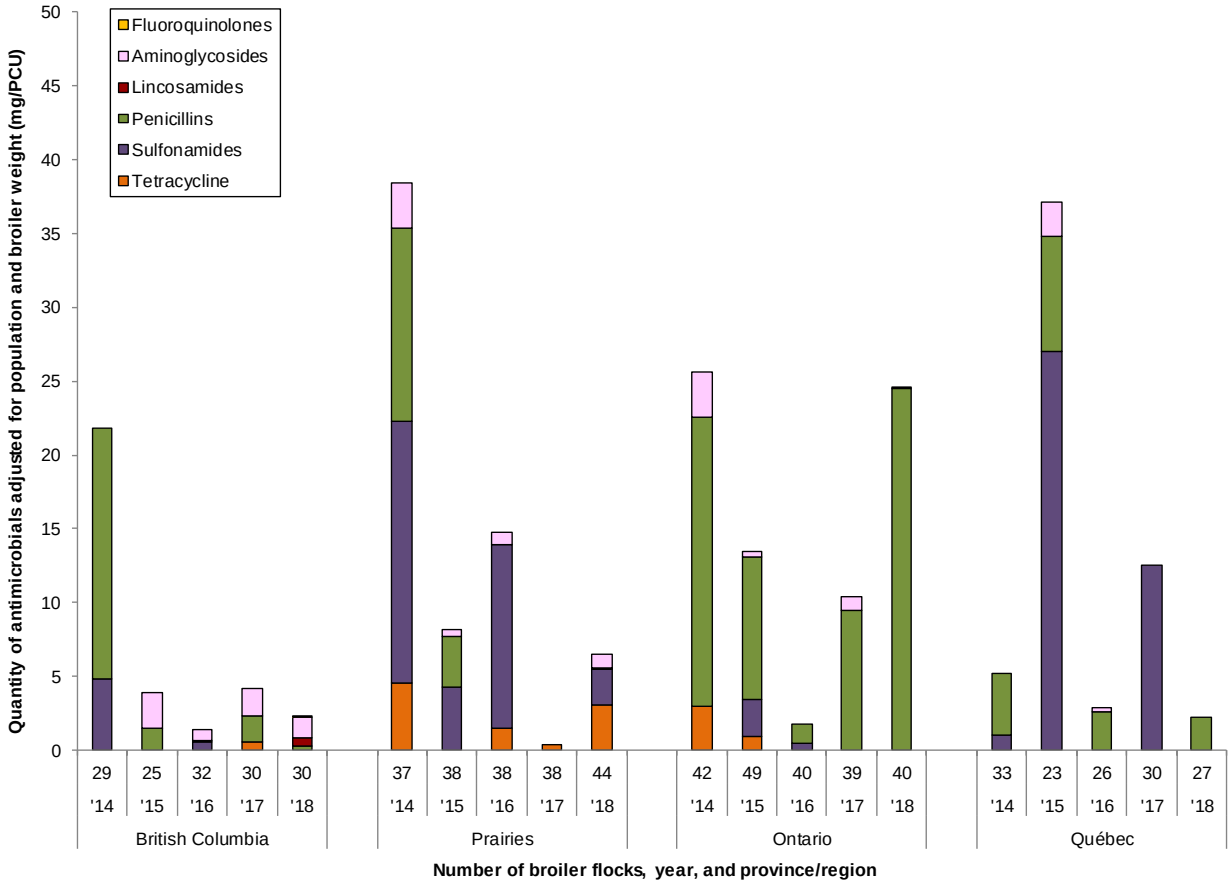
Numbers per column may not add up to 100% as some flocks have used an antimicrobial more than once or used multiple antimicrobials throughout the growing period.

For the temporal analyses within province/region, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province/region ($P \leq 0.05$) for a given antimicrobial. The presence of red areas indicates significant provincial/regional differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given antimicrobial.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Antimicrobials use in water by quantitative indicators

Figure 2. 20 Quantity of antimicrobial use in water adjusted for population and broiler weight (mg/PCU), 2014 to 2018



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Antimicrobial class																					
I	Fluoroquinolones	0	0	0	0	< 0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
II	Aminoglycosides	0	2	1	2	1	3	1	1	0	1	3	0.4	0	1	0	0	2	0	0	0
	Lincosamides	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Penicillins	17	1	0	2	0.3	13	3	0	0	0	20	10	1	9	25	4	8	3	0	2
III	Sulfonamides	5	0	1	0	0	18	4	12	0	2	0	2	0	0	0	1	27	0	13	0
	Tetracyclines	0	0	0	1	0	5	0	2	0	3	3	1	0	0	0	0	0	0	0	0
Total		**22**	**4**	**1**	**4**	**2**	**38**	**8**	**15**	**0**	**7**	**26**	**13**	**2**	**10**	**25**	**5**	**37**	**3**	**13**	**2**

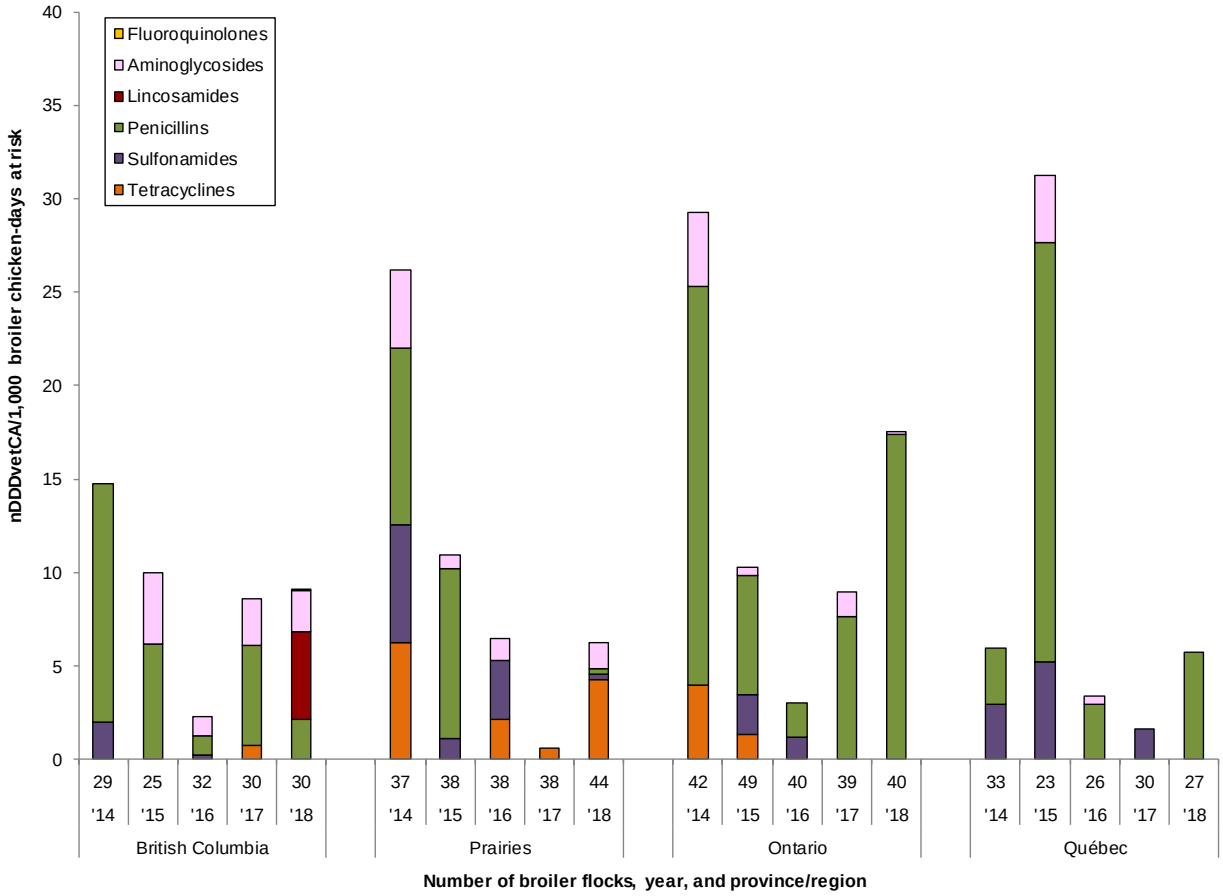
Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 2. 21 Number of Canadian Defined Daily Doses for animals per 1,000 broiler chicken-days at risk (nDDDvetCA/1,000 broiler chicken-days at risk) for antimicrobials administered in water, 2014 to 2018



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Antimicrobial class																					
I	Fluoroquinolones	0	0	0	0	< 0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
II	Aminoglycosides	0	4	1	3	2	4	1	1	0	1	4	0.4	0	1	0.1	0	4	0.5	0	0
	Lincosamides	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Penicillins	13	6	1	5	2	9	9	0	0	0.3	21	6	2	8	17	3	22	3	0	6
III	Sulfonamides	2	0	0	0	0	6	1	3	0	0	0	2	1	0	0	3	5	0	2	0
	Tetracyclines	0	0	0	1	0	6	0	2	1	4	4	1	0	0	0	0	0	0	0	0
Total		**15**	**10**	**2**	**9**	**9**	**26**	**11**	**6**	**1**	**6**	**29**	**10**	**3**	**9**	**18**	**6**	**31**	**3**	**2**	**6**

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

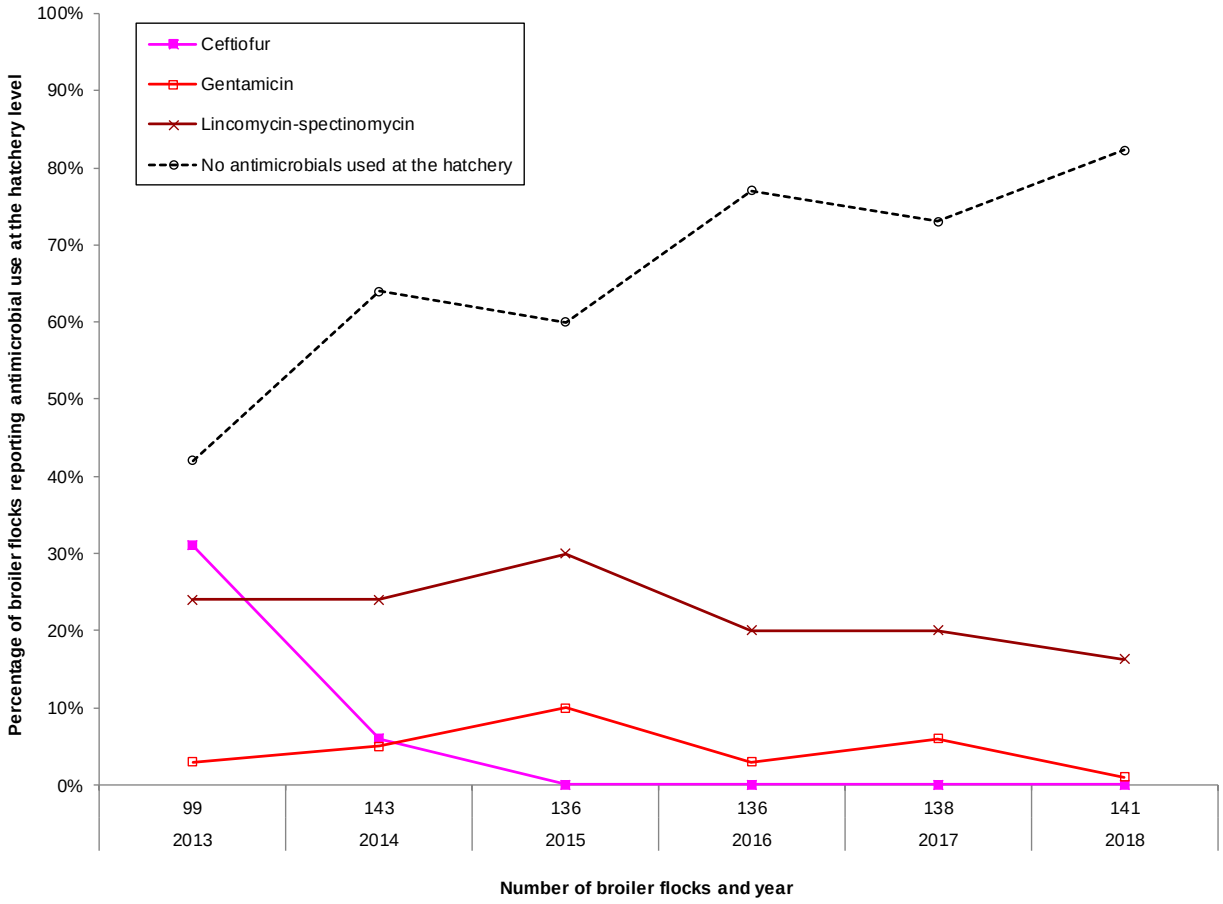
nDDDvetCA/1,000 broiler chicken-days at risk = number of DDDvetCA/1,000 broiler chicken-days at risk .

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Antimicrobial use *in ovo* or subcutaneous injection by frequency

Figure 2. 22 Percentage of broiler flocks reporting antimicrobial use *in ovo* or subcutaneous injection at the hatchery level, 2013 to 2018



Year	2013	2014	2015	2016	2017	2018
Number of flocks	99	143	136	136	138	141
Antimicrobial						
I Ceftiofur	**31%**	6%	0%	0%	**0%**	**0%**
II Gentamicin	**3%**	5%	10%	3%	**6%**	**1%**
II Lincomycin-spectinomycin	**24%**	24%	30%	20%	**20%**	**16%**
No antimicrobials used at the hatchery	**42%**	64%	60%	77%	**73%**	**82%**

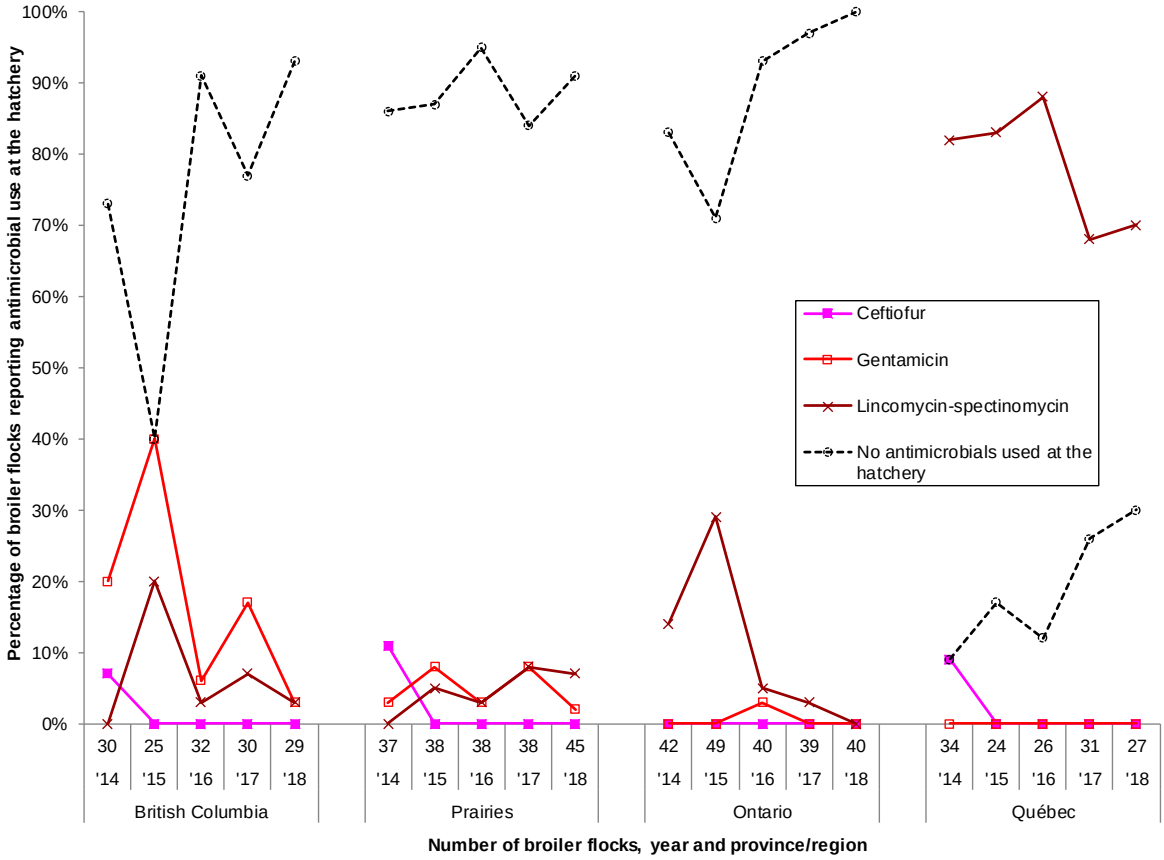
Roman numerals I to II indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

Numbers per column may not add up to 100% due to rounding or batches of chicks (hatched at the same time to supply 1 barn) may have used more than one antimicrobial.

Data represent flocks medicated at the hatchery at day 18 of incubation or upon hatch.

For the temporal analyses, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in the first and previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.

Figure 2. 23 Percentage of broiler flocks reporting antimicrobials used *in ovo* or subcutaneous injection at the hatchery level by province/region, 2014 to 2018



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks	30	25	32	30	29	37	38	38	38	45	42	49	40	39	40	34	24	26	31	27
Antimicrobial																				
I Ceftiofur	**7%**	0%	0%	**0%**	**0%**	**11%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**9%**	0%	0%	**0%**	**0%**
II Gentamicin	**20%**	40%	6%	**17%**	**3%**	**3%**	8%	3%	**8%**	**2%**	**0%**	0%	3%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
II Lincomycin-spectinomycin	**0%**	20%	3%	**7%**	**3%**	**0%**	5%	3%	**8%**	**7%**	**14%**	29%	5%	**3%**	**0%**	**82%**	83%	88%	**68%**	**70%**
No antimicrobials used at the hatchery	**73%**	40%	91%	**77%**	**93%**	**86%**	87%	95%	**84%**	**91%**	**83%**	71%	93%	**97%**	**100%**	**9%**	17%	12%	**26%**	**30%**

Roman numerals I to II indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

Numbers per column may not add up to 100% due to rounding or batches of chicks (hatched at the same time to supply 1 barn) may have used more than one antimicrobial.

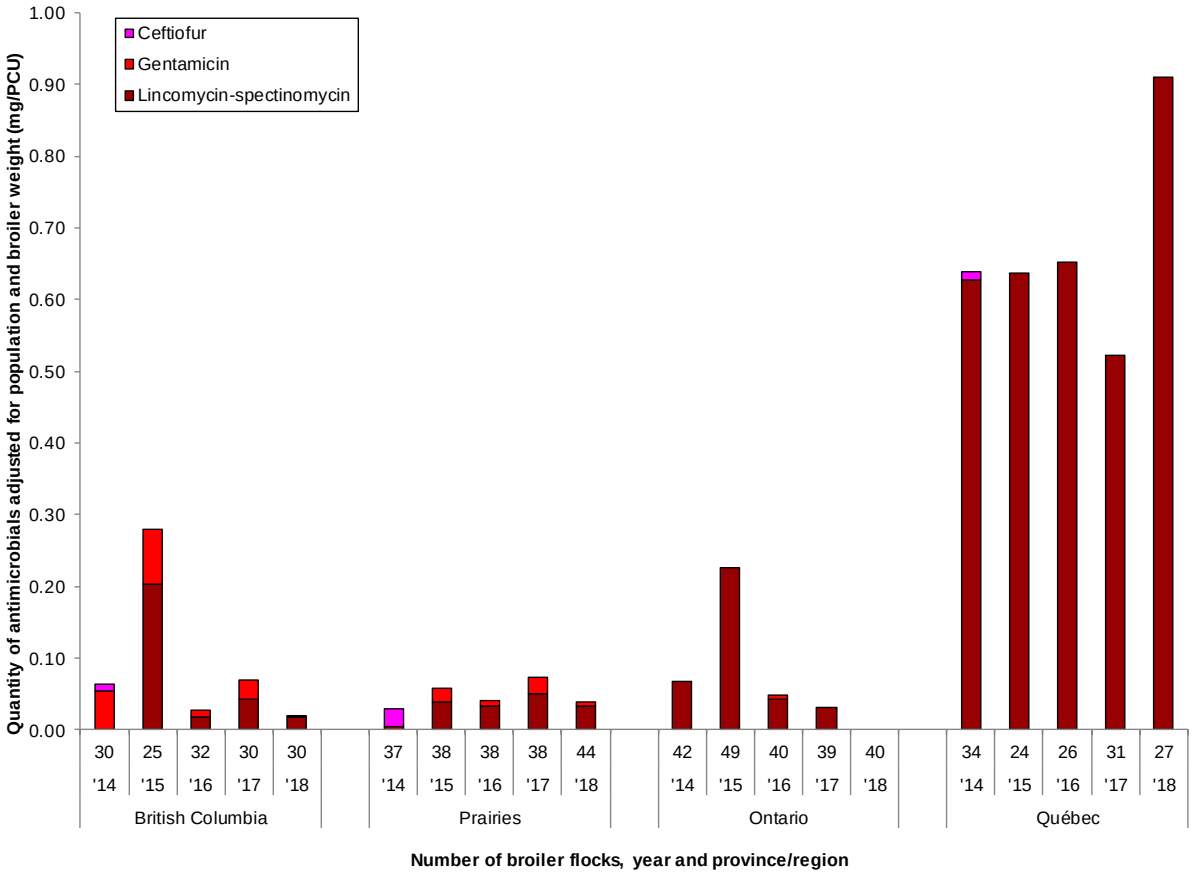
Data represent flocks medicated at the hatchery at day 18 of incubation or upon hatch.

For the temporal analyses within province/region, the proportion (%) of flocks using antimicrobial over the current year has been compared to the proportion (%) of flocks using the same antimicrobial during the first and the previous surveillance year (grey areas). The presence of blue areas indicate significant differences ($P \leq 0.05$) for a given province/region and antimicrobial. The presence of red areas indicates significant provincial/regional differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given antimicrobial.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Antimicrobial use *in ovo* or subcutaneous injection by quantitative indicators

Figure 2. 24 Quantity of antimicrobial use *in ovo* or subcutaneous injections, adjusted for population and broiler weight (mg/PCU), 2014 to 2018



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks	30	25	32	30	30	37	38	38	38	44	42	49	40	39	40	34	24	26	31	27
Antimicrobial																				
I Ceftiofur	0.01	0	0	0	0	0.03	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0
II Gentamicin	0.06	0.08	0.01	0.03	0.002	0.004	0.02	0.01	0.02	0.01	0	0	0.01	0	0	0	0	0	0	0
II Lincomycin-spectinomycin	0	0.2	0.02	0.04	0.02	0	0.04	0.03	0.05	0.02	0.07	0.23	0.04	0.03	0	0.63	0.64	0.65	0.52	0.91
Total	**0.06**	**0.3**	**0.03**	**0.07**	**0.02**	**0.03**	**0.06**	**0.04**	**0.07**	**0.04**	**0.07**	**0.23**	**0.05**	**0.03**	**0**	**0.64**	**0.64**	**0.65**	**0.52**	**0.91**

Roman numerals I to II indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

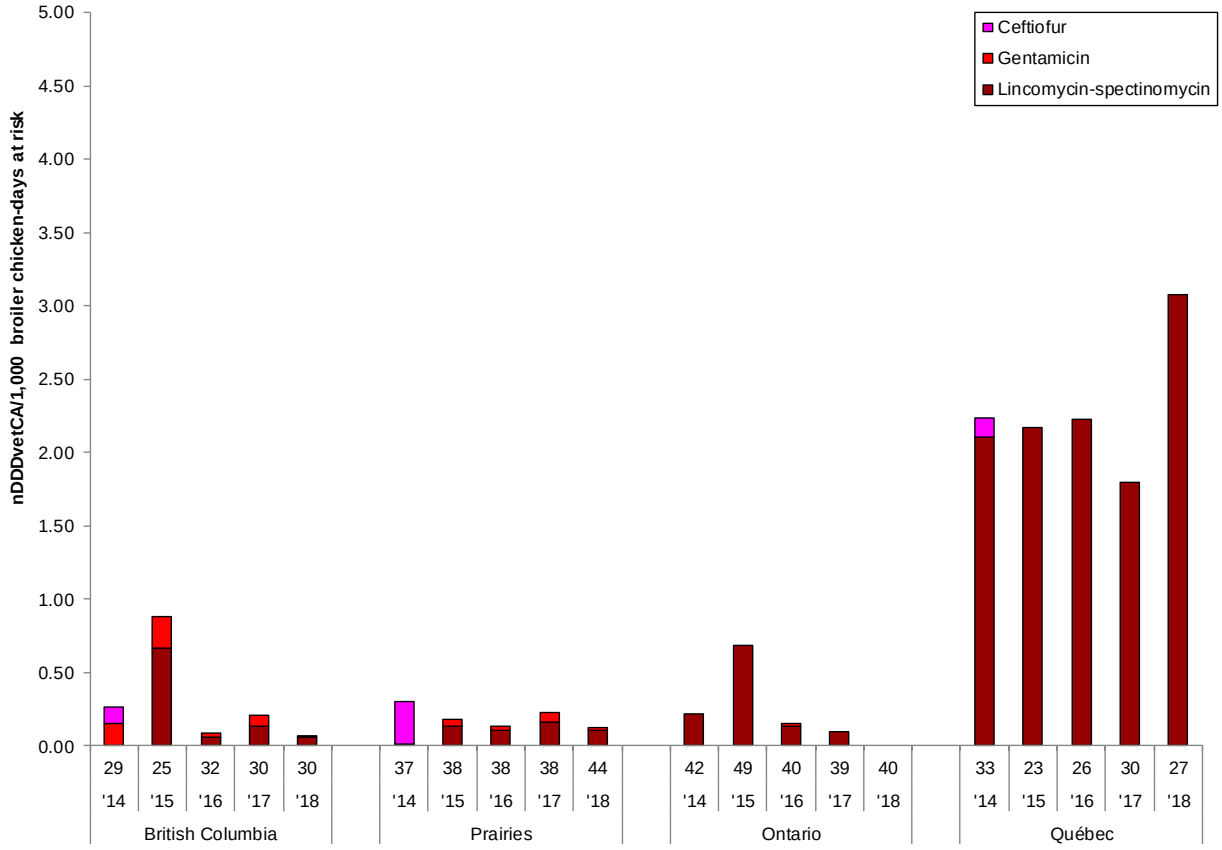
Total milligrams active ingredient was calculated using the final dose (in milligrams per hatching egg or chick) suggested by the manufacturer and expert opinion based on milligrams per body weight or residue avoidance information.

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 2. 25 Number of Canadian Defined Daily Doses for animals per 1,000 broiler chicken-days at risk (nDDDvetCA/1,000 broiler chicken-days at risk) for antimicrobials administered *in ovo* or subcutaneous injection, 2014 to 2018



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Antimicrobial																					
I	Ceftiofur	0.11	0	0	0	0	0.30	0	0	0	0	0	0	0	0	0	0.13	0	0	0	0
II	Gentamicin	0.16	0.21	0.02	0.07	0.005	0.01	0.05	0.03	0.07	0.01	0	0	0	0	0	0	0	0	0	0
	Lincomycin-spectinomycin	0	0.67	0.06	0.14	0.06	0	0.13	0.11	0.16	0.11	0.21	0.68	0.14	0.10	0	2.11	2.17	2.23	1.80	3.08
	Total	**0.27**	**0.88**	**0.09**	**0.21**	**0.06**	**0.31**	**0.18**	**0.13**	**0.23**	**0.12**	**0.21**	**0.68**	**0.15**	**0.10**	**0**	**2.24**	**2.17**	**2.23**	**1.80**	**3.08**

Roman numerals I to II indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

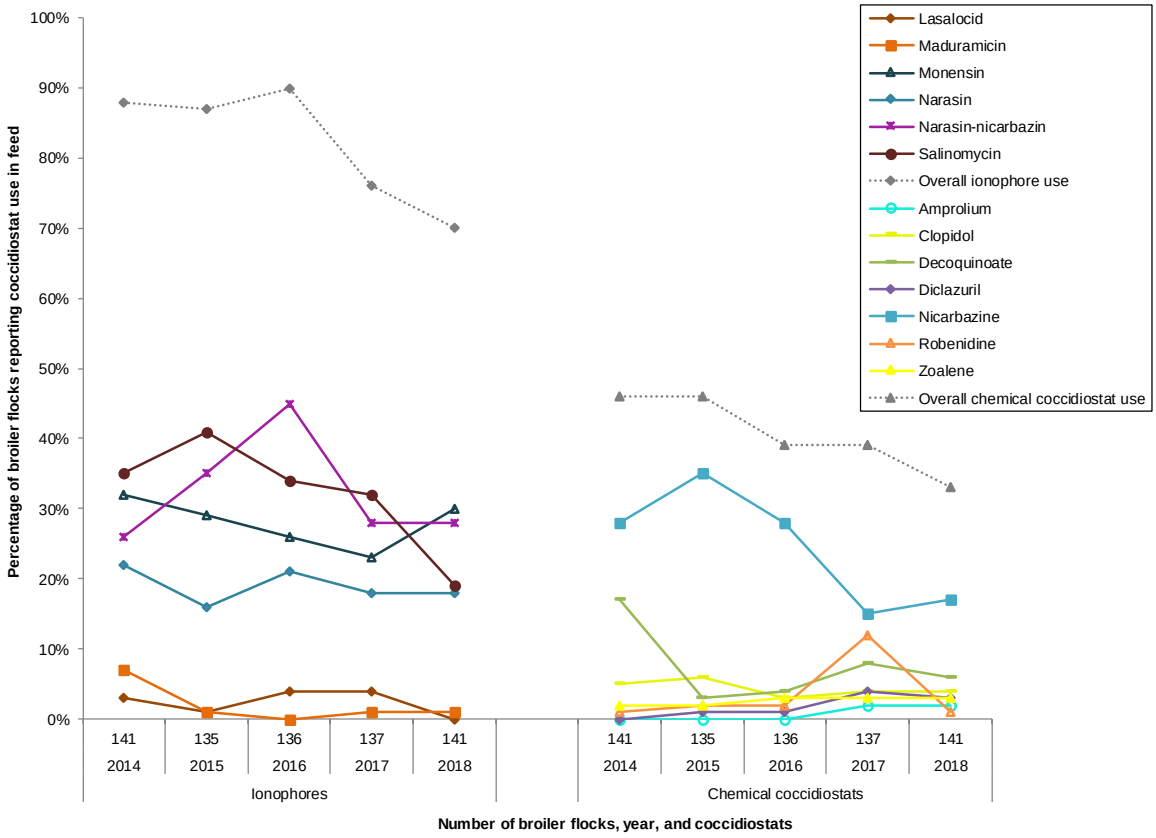
nDDDvetCA/1,000 broiler chicken-days at risk = number of DDDvetCA/1,000 broiler chicken-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Coccidiostat use in feed by frequency

Figure 2. 26 Percentage of broiler flocks reporting coccidiostat use in feed, 2014 to 2018

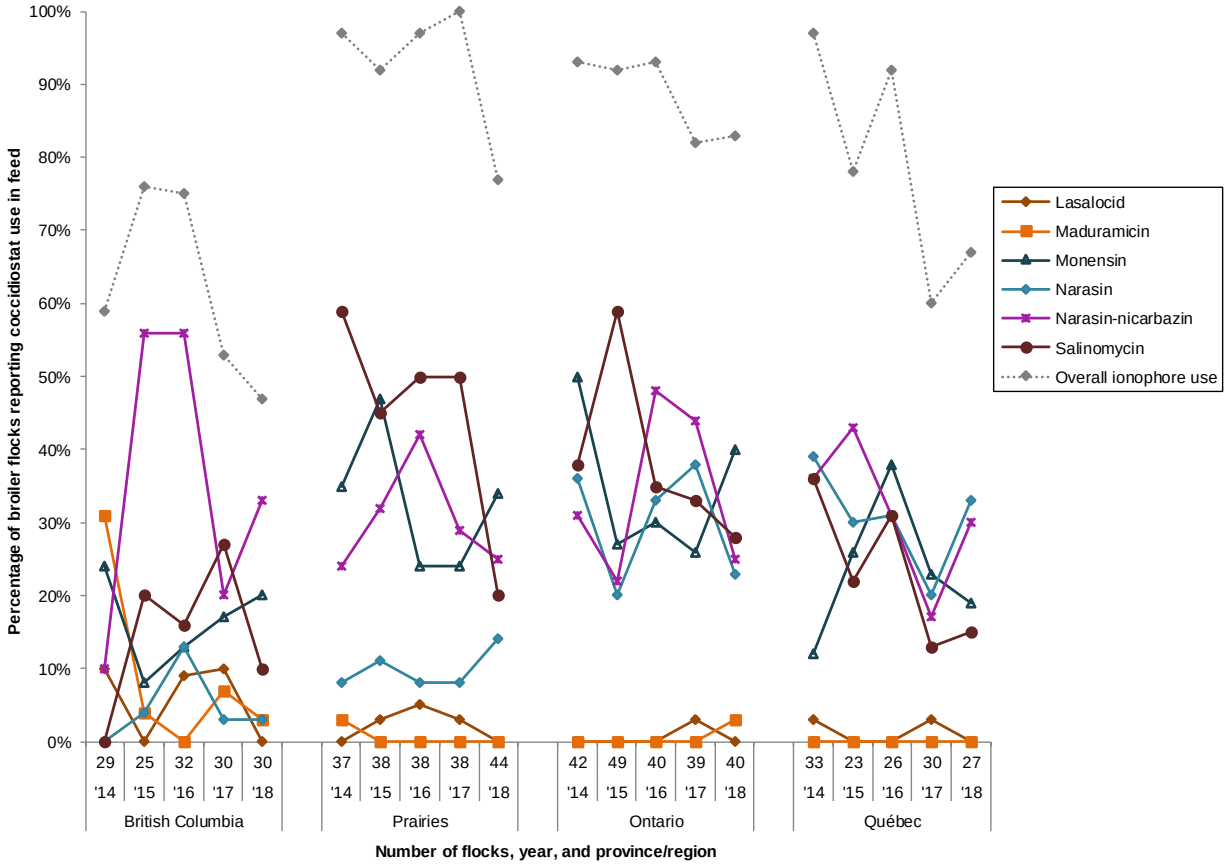


Year	2014	2015	2016	2017	2018
Number of flocks	141	135	136	137	141
Coccidiostat					
IV Lasalocid	**3%**	1%	4%	**4%**	**0%**
IV Maduramicin	**7%**	1%	0%	**1%**	**1%**
IV Monensin	**32%**	29%	26%	**23%**	**30%**
IV Narasin	**22%**	16%	21%	**18%**	**18%**
IV Narasin-nicarbazin	**26%**	35%	45%	**28%**	**28%**
IV Salinomycin	**35%**	41%	34%	**32%**	**19%**
IV **Overall ionophore use**	**88%**	87%	90%	**76%**	**70%**
N/A Amprolium	**0%**	0%	0%	**2%**	**2%**
N/A Clopidol	**5%**	6%	3%	**4%**	**4%**
N/A Decoquinoate	**17%**	3%	4%	**8%**	**6%**
N/A Diclazuril	**0%**	1%	1%	**4%**	**3%**
N/A Nicarbazine	**28%**	35%	28%	**15%**	**17%**
N/A Robenidine	**1%**	2%	2%	**12%**	**1%**
N/A Zoalene	**2%**	2%	3%	**3%**	**3%**
N/A **Overall chemical coccidiostat use**	**46%**	46%	39%	**39%**	**33%**

Roman numeral IV indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).

For the temporal analyses, the proportion (%) of flocks using a specific coccidiostat in the current year has been compared to the proportion (%) of flocks using the same coccidiostat in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given coccidiostat.

Figure 2. 27 Percentage of broiler flocks reporting ionophore coccidiostats in feed, by province/region, 2014 to 2018



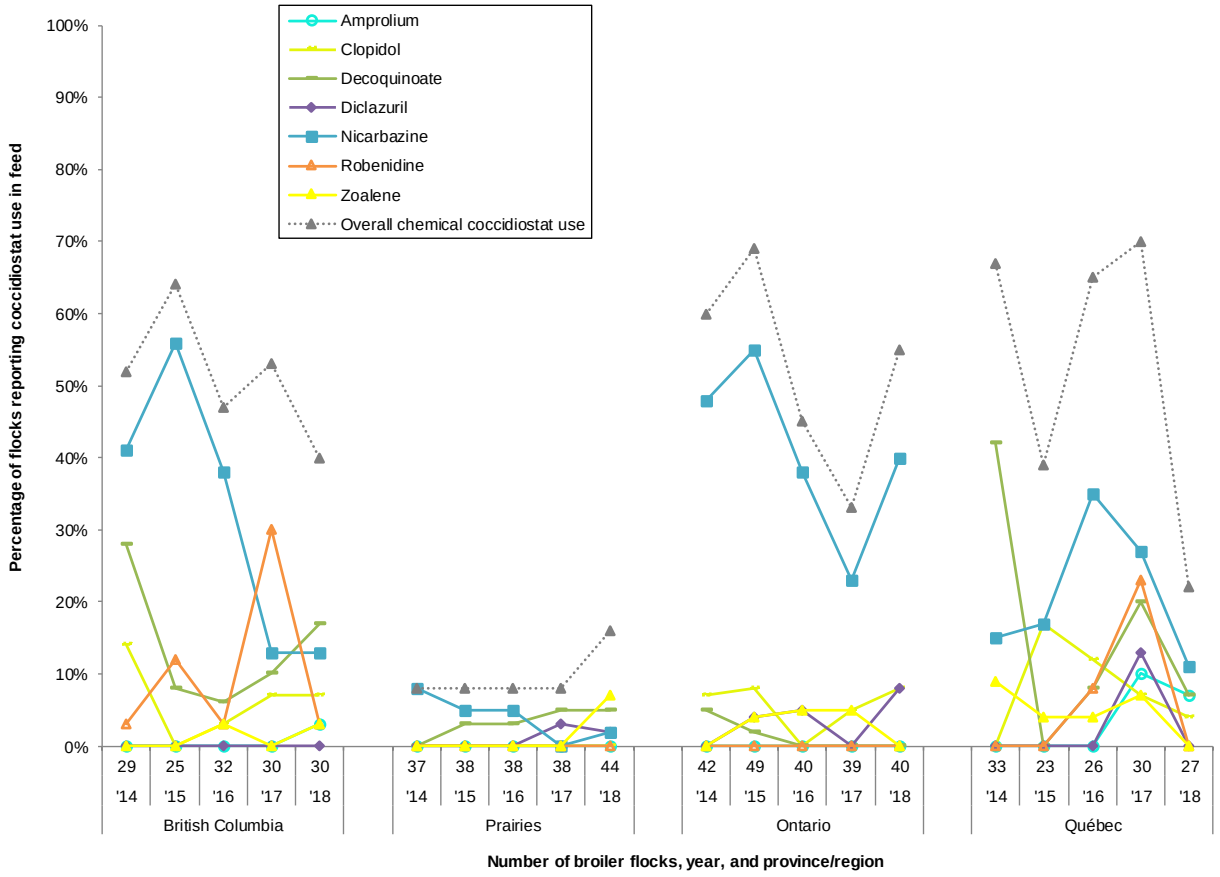
Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Coccidiostat																					
	Lasalocid	**10%**	0%	9%	**10%**	**0%**	**0%**	3%	5%	**3%**	**0%**	**0%**	0%	0%	**3%**	**0%**	**3%**	0%	0%	**3%**	**0%**
	Maduramicin	**31%**	4%	0%	**7%**	**3%**	**3%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**3%**	**0%**	0%	0%	**0%**	**0%**
	Monensin	**24%**	8%	13%	**17%**	**20%**	**35%**	47%	24%	**24%**	**34%**	**50%**	27%	30%	**26%**	**40%**	**12%**	26%	38%	**23%**	**19%**
IV	Narasin	**0%**	4%	13%	**3%**	**3%**	**8%**	11%	8%	**8%**	**14%**	**36%**	20%	33%	**38%**	**23%**	**39%**	30%	31%	**20%**	**33%**
	Narasin-nicarbazin	**10%**	56%	56%	**20%**	**33%**	**24%**	32%	42%	**29%**	**25%**	**31%**	22%	48%	**44%**	**25%**	**36%**	43%	31%	**17%**	**30%**
	Salinomycin	**0%**	20%	16%	**27%**	**10%**	**59%**	45%	50%	**50%**	**20%**	**38%**	59%	35%	**33%**	**28%**	**36%**	22%	31%	**13%**	**15%**
	Overall ionophores use	**59%**	76%	75%	**53%**	**47%**	**97%**	92%	97%	**100%**	**77%**	**93%**	92%	93%	**82%**	**83%**	**97%**	78%	92%	**60%**	**67%**

Roman numeral IV indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate.

For the temporal analyses within province/region, the proportion (%) of flocks using a specific ionophore in the current year has been compared to the proportion (%) of flocks using the same ionophore in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province/region ($P \leq 0.05$) for a given ionophore. The presence of red areas indicates significant provincial/regional differences ($P \leq 0.05$) for a given ionophore within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given ionophore.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 2. 28 Percentage of broiler flocks reporting chemical coccidiostats in feed, by province/region, 2014 to 2018



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Coccidiostat																					
N/A	Amprolium	**0%**	0%	0%	**0%**	**3%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**10%**	**7%**
	Clopidol	**14%**	0%	3%	**7%**	**7%**	**0%**	0%	0%	**0%**	**0%**	**7%**	8%	0%	**5%**	**8%**	**0%**	17%	12%	**7%**	**4%**
	Decoquinoate	**28%**	8%	6%	**10%**	**17%**	**0%**	3%	3%	**5%**	**5%**	**5%**	2%	0%	**0%**	**0%**	**42%**	0%	8%	**20%**	**7%**
	Diclazuril	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**3%**	**2%**	**0%**	4%	5%	**0%**	**8%**	**0%**	0%	0%	**13%**	**0%**
	Nicarbazine	**41%**	56%	38%	**13%**	**13%**	**8%**	5%	5%	**0%**	**2%**	**48%**	55%	38%	**23%**	**40%**	**15%**	17%	35%	**27%**	**11%**
	Robenidine	**3%**	12%	3%	**30%**	**3%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	8%	**23%**	**0%**
	Zoalene	**0%**	0%	3%	**0%**	**3%**	**0%**	0%	0%	**0%**	**7%**	**0%**	4%	5%	**5%**	**0%**	**9%**	4%	4%	**7%**	**0%**
	Overall chemical coccidiostat use	**52%**	64%	47%	**53%**	**40%**	**8%**	8%	8%	**8%**	**16%**	**60%**	69%	45%	**33%**	**55%**	**67%**	39%	65%	**70%**	**22%**

N/A = not applicable (no classification at the time of writing of this report).

For the temporal analyses within province/region, the proportion (%) of flocks using a specific chemical coccidiostat in the current year has been compared to the proportion (%) of flocks using the same chemical coccidiostat in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province/region ($P \leq 0.05$) for a given chemical coccidiostat. The presence of red areas indicates significant provincial/regional differences ($P \leq 0.05$) for a given chemical coccidiostat within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given chemical coccidiostat.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Farm Surveillance in grower-finisher pigs

Summary of antimicrobial use by route of administration

Table 2. 9 Number of grower-finisher pig herds with reported antimicrobial use by route of administration, 2018

Data available upon request.

Table 2. 10 Frequency and quantity of antimicrobial use in feed in grower-finisher pigs, excluding ionophores, 2018

Route of administration	Antimicrobial	Herds n (%) Total n = 97	Rations n (%) *Total n = 432	Ration days exposed[a] median (min. ; max.)	Percent of herd exposed median (min. ; max.)	Weight at exposure median[b] (min. ; max.)[c]	Level of drug g/tonne[d] median (min. ; max.)	Quantity of antimicrobial active ingredient[e]	
								mg/PCU	nDDDvetCA / 1,000 GF pig-days at risk
Feed									
II	Lincomycin	24 (25)	41 (9)	25 (3; 70)	100 (50; 100)	75 (23; 130)	44 (22; 110)	24	46
	Lincomycin (combination with spectinomycin)	(0)	(0)	0 (0; 0)	0 (0; 0)	0 (0; 0)	0 (0; 0)	0	0
	Tilmicosin	0 (0)	(0)	0 (0; 0)	0 (0; 0)	0 (0; 0)	0 (0; 0)	0	0
	Tylosin	16 (16)	28 (6)	28 (4; 63)	100 (50; 100)	68 (20; 135)	44 (22; 110)	13	36
	Tylvalosin	7 (7)	8 (2)	21 (11; 28)	100 (100; 100)	55 (25; 90)	43 (43; 85)	2	11
	Penicillin	5 (5)	5 (1)	21 (6; 35)	100 (100; 100)	38 (23; 58)	55 (55; 312)	2	11
	Virginiamycin	1 (1)	3 (1)	14 (14; 70)	100 (100; 100)	45 (27; 122)	11 (11; 11)	1	2
III	Spectinomycin (combination with lincomycin)	0 (0)	(0)	0 (0; 0)	0 (0; 0)	0 (0; 0)	0 (0; 0)	0	0
	Bacitracin	0 (0)	(0)	0 (0; 0)	0 (0; 0)	0 (0; 0)	0 (0; 0)	0	0
	Tiamulin	7 (7)	11 (3)	28 (5; 35)	100 (100; 100)	44 (20; 100)	31 (9; 39)	3	4
	Sulfamethazine	4 (4)	4 (1)	28 (6; 35)	100 (100; 100)	38 (23; 58)	110 (110; 625)	3	6
	Chlortetracycline	18 (19)	26 (6)	21 (3; 49)	100 (50; 100)	39 (22; 100)	330 (110; 625)	62	52
	Oxytetracycline	1 (1)	1 (0)	15 (15; 15)	100 (100; 100)	36 (25; 47)	220 (220; 220)	2	2
IV	Bambermycin	2 (2)	5 (1)	28 (21; 56)	100 (100; 100)	55 (25; 125)	2 (2; 2)	0.16	
Medicated feed		**57 (59)**	**132 (31)**	**21 (3; 70)**	**100 (50; 100)**	**55 (20; 135)**	**44 (2; 625)**	**110**	**171**
No AMU in feed		40 (41)	223 (52)	28 (3; 70)	100 (50; 100)	77 (20; 284)	0 (0; 0)		

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

Grey shaded cells = no data or calculations/values are not applicable for grower-finisher pigs.

mg/PCU = milligrams/population correction unit.

DDDvetCA = Canadian Defined Daily Doses (average labelled dose) in milligrams per kilogram grower-finisher pig weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 2 for the list of standards.

nDDDvetCA/1,000 GF pig-days at risk = number of DDDvetCA/1,000 grower-finisher pig-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

[a] Ration days exposed = for rations medicated with the specific antimicrobial and do not reflect the full grow-out period.

[b] Median weight at exposure = the median of all average weights of pigs exposed to a ration containing a specific antimicrobial [(Ration Start Weight + Ration End Weight)/2].

[c] Minimum (min.) and maximum (max.) pig weight at exposure = the lowest start weight and the highest end weight reported for all rations containing the specific antimicrobial, respectively.

[d] Level of drug is in grams/tonne of feed.

[e] Quantitative antimicrobial consumption estimates were calculated using reported ration days fed and predicted feed intake[5], adjusted for herd average daily gain; only rations medicated with the specific antimicrobial were included in this analysis; the final mg/PCU and nDDDvetCA/1,000 GF pig-days at risk exclude coccidiostats and pyrimethamine. Flavophospholipids was included only in the mg/PCU.

[5] National Research Council. 2012. Nutrient Requirements of Swine, Eleventh Edition. Washington, DC: National Academy Press.

Table 2. 11 Production, biomass and quantity of antimicrobials used in feed in grower-finisher pigs by province/region, 2014 to 2018

Province/ region	Year	Number of herds	Number of rations	Proportion of rations medicated	Average weight at exposure median (min ; max)	Average grow-finish period	Active ingredient	Grower-finisher pig weights[a]	mg/PCU		nDDDvetCA / 1,000 GF pig-days at risk	
		Total	Total	%	(kg)	(Days)	(mg)	(kg)	Total	% change[b]	Total	% change[b]
Prairies	2014	43	205	61	68 (25; 118)	109	842,082,712	5,075,220	166		308	
	2015	39	165	53	70 (25; 121)	111	854,877,885	5,493,810	156	-6	268	-13
	2016	40	176	49	69 (28; 136)	112	548,609,650	5,438,142	101	-35	217	-19
	2017	40	151	29	68 (23; 215)	111	562,073,067	5,359,508	105	4	177	-18
	2018	44	189	35	68 (28; 194)	112	747,148,116	5,523,828	135	29	193	9
Ontario	2014	26	109	54	70 (27; 125)	110	358,536,769	2,378,448	151		294	
	2015	25	96	51	70 (27; 125)	114	454,971,382	2,306,070	197	31	325	10
	2016	27	95	51	63 (28; 125)	114	298,836,760	2,422,905	123	-37	200	-39
	2017	22	87	54	70 (30; 125)	110	189,631,838	1,333,670	142	15	259	30
	2018	31	111	39	70 (30; 135)	112	225,663,425	2,152,361	105	-26	192	-26
Québec	2014	26	79	73	63 (25; 118)	121	393,818,303	2,232,588	176		255	
	2015	21	67	75	58 (22; 119)	115	393,836,556	1,864,200	211	20	268	5
	2016	24	52	48	59 (25; 120)	117	262,132,293	1,744,568	150	-29	164	-39
	2017	20	59	39	63 (30; 123)	125	135,113,791	1,809,600	75	-50	130	-21
	2018	22	56	41	61 (30; 120)	121	99,341,402	2,052,375	48	-35	94	-27
National[c]	2014	95	393	62	68 (25; 125)	112	1,594,437,784	9,686,255	165		290	
	2015	85	328	57	67 (22; 125)	113	1,703,685,823	9,664,080	176	7	281	-3
	2016	91	323	49	67 (25; 136)	114	1,109,578,703	9,605,614	116	-34	202	-28
	2017	82	297	38	68 (23; 215)	114	886,818,695	8,502,778	104	-10	178	-12
	2018	97	356	37	68 (28; 194)	114	1,072,152,942	9,728,564	110	6	171	-4

This analysis excludes ionophores.

mg/PCU = milligrams/population correction unit.

ESVAC = European Surveillance of Veterinary Antimicrobial Consumption.

DDDvetCA = Canadian Defined Daily Doses (average labelled dose) in milligrams per kilogram grower-finisher pig weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 2 for the list of standards.

nDDDvetCA/1,000 GF pig-days at risk = number of DDDvetCA/1,000 grower-finisher pig-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

[a] Population correction unit (PCU) or biomass, European weight (total herd population x ESVAC standard weight of 65 kg pig).

[b] Percent change = [(current surveillance year – previous surveillance year)/previous surveillance year] x 100.

[c] Includes only the provinces/regions surveyed and includes only the quantity of antimicrobials used in feed, excluding ionophores.

Table 2. 12 Frequency and quantity of ionophore coccidiostats use in feed in grower-finisher pigs, 2018

Route of administration	Antimicrobial	Herds n (%) Total n = 97	Rations n (%) *Total n = 432	Ration days exposed[a] median (min. ; max.)	Percent of herd exposed median (min. ; max.)	Weight at exposure median[b] (min. ; max.)[c]	Level of drug g/tonne[d] median (min. ; max.)	Quantity of antimicrobial active ingredient[e] (mg/PCU)
Feed								
IV	Narasin	10 (10)	31 (7)	28 (7; 56)	100 (100; 100)	55 (20; 132)	15 (15; 150)	9
	Salinomycin	14 (14)	46 (11)	28 (7; 56)	100 (50; 100)	74 (20; 140)	25 (15; 60)	16
All ionophore use		**24 (24)**	**77 (18)**	**28 (7; 56)**	**100 (50; 100)**	**69 (20; 140)**	**25 (15; 150)**	**26**

Roman numeral IV indicates the ranking of antimicrobials based on importance to human medicine as outlined by the Veterinary Drugs Directorate.

Grey shaded cells = No data or calculations/values are not applicable for grower-finisher pigs.

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

[a] Ration days exposed = for rations medicated with the specific antimicrobial and do not reflect the full grow-out period.

[b] Median weight at exposure = the median of all average weights of pigs exposed to a ration containing a specific antimicrobial [(Ration Start Weight + Ration End Weight)/2].

[c] Minimum (min.) and maximum (max.) pig weight at exposure = the lowest start weight and the highest end weight reported for all rations containing the specific antimicrobial, respectively.

[d] Level of drug is in grams/tonne of feed.

[e] Quantitative antimicrobial consumption estimates were calculated using reported ration days fed and predicted feed intake[6], adjusted for herd average daily gain; only rations medicated with the specific antimicrobial were included in this analysis.

[6] National Research Council. 2012. Nutrient Requirements of Swine, Eleventh Edition. Washington, DC: National Academy Press.

Table 2. 13 Production, biomass and quantity of ionophore coccidiostats used in feed in grower-finisher pigs by province/region, 2014 to 2018

Province/ region	Year	Proportion of herds using ionophores	Proportion of rations med. with ionophores	Duration of exposure Mean (min ; max)	Average weight at exposure Median (min ; max)	Active ingredient	Average grow-finish period	Grower-finisher pig weights[a]	mg/PCU	
		n (%)	n (%)	(Days)	(kg)	(mg)	(Days)	(kg)	Total	%change[b]
Prairies	2014	9 (21)	26 (11)	26 (14 ; 35)	69 (20 ; 120)	68,166,364	109	5,075,220	13	
	2015	10 (26)	39 (19)	30 (7 ; 56)	69 (23 ; 120)	95,423,770	109	5,493,810	17*	29*
	2016	6 (15)	25 (12)	29 (7 ; 42)	70 (27 ; 120)	99,004,624	111	5,438,142	18	5
	2017	7 (18)	28 (16)	33 (7 ; 42)	74 (27 ; 120)	127,822,238	112	5,359,508	24	31
	2018	7 (16)	25 (12)	31 (7 ; 56)	69 (27 ; 132)	137,302,834	111	5,523,828	25	4
Ontario	2014	0 (0)	0 (0)	0 (0 ; 0)	0 (0 ; 0)	0	108	2,378,448	0	
	2015	3 (12)	9 (9)	26 (21 ; 32)	77 (30 ; 120)	16,760,072	110	2,306,070	7	0
	2016	4 (15)	10 (10)	33 (14 ; 84)	72 (30 ; 121)	24,535,301	114	2,422,905	10	
	2017	2 (9)	5 (5)	37 (22 ; 84)	83 (43 ; 130)	11,309,951	114	1,333,670	8	-16
	2018	4 (13)	12 (10)	29 (14 ; 56)	75 (25 ; 130)	31,120,045	110	2,152,361	14	70
Québec	2014	13 (50)	37 (32)	32 (14 ; 56)	72 (25 ; 140)	88,321,296	113	2,232,588	40	
	2015	8 (38)	25 (27)	32 (7 ; 56)	79 (25 ; 130)	89,069,930	121	1,864,200	48	21
	2016	14 (58)	44 (46)	32 (7 ; 56)	79 (25 ; 136)	108,368,724	115	1,744,568	62	30
	2017	9 (45)	31 (34)	31 (11 ; 63)	75 (21 ; 135)	43,375,641	117	1,809,600	24	-61
	2018	11 (50)	40 (42)	31 (7 ; 56)	72 (20 ; 140)	82,197,249	125	2,052,375	40	67
National[c]	2014	22 (23)	63 (14)	29 (14 ; 56)	71 (20 ; 140)	156,487,660	110	9,686,255	16	
	2015	21 (25)	73 (18)	30 (7 ; 56)	74 (23 ; 130)	201,253,771	112	9,664,080	21*	29*
	2016	24 (26)	79 (20)	31 (7 ; 84)	75 (25 ; 136)	231,908,649	113	9,605,614	24	16
	2017	18 (22)	64 (18)	33 (7 ; 84)	76 (21 ; 135)	182,507,830	114	8,502,778	21	-11
	2018	22 (23)	77 (18)	30 (7 ; 56)	71 (20 ; 140)	250,620,128	114	9,728,564	26	20

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to the CIPARS 2018 Design and methods document.

The Prairies is a region and includes the provinces of Alberta, Saskatchewan, and Manitoba.

* An extreme outlier value for "Active Ingredient (mg)" consumed was removed - this extreme increase in salinomycin use was validated and attributed to a use in one herd in 2015 only.

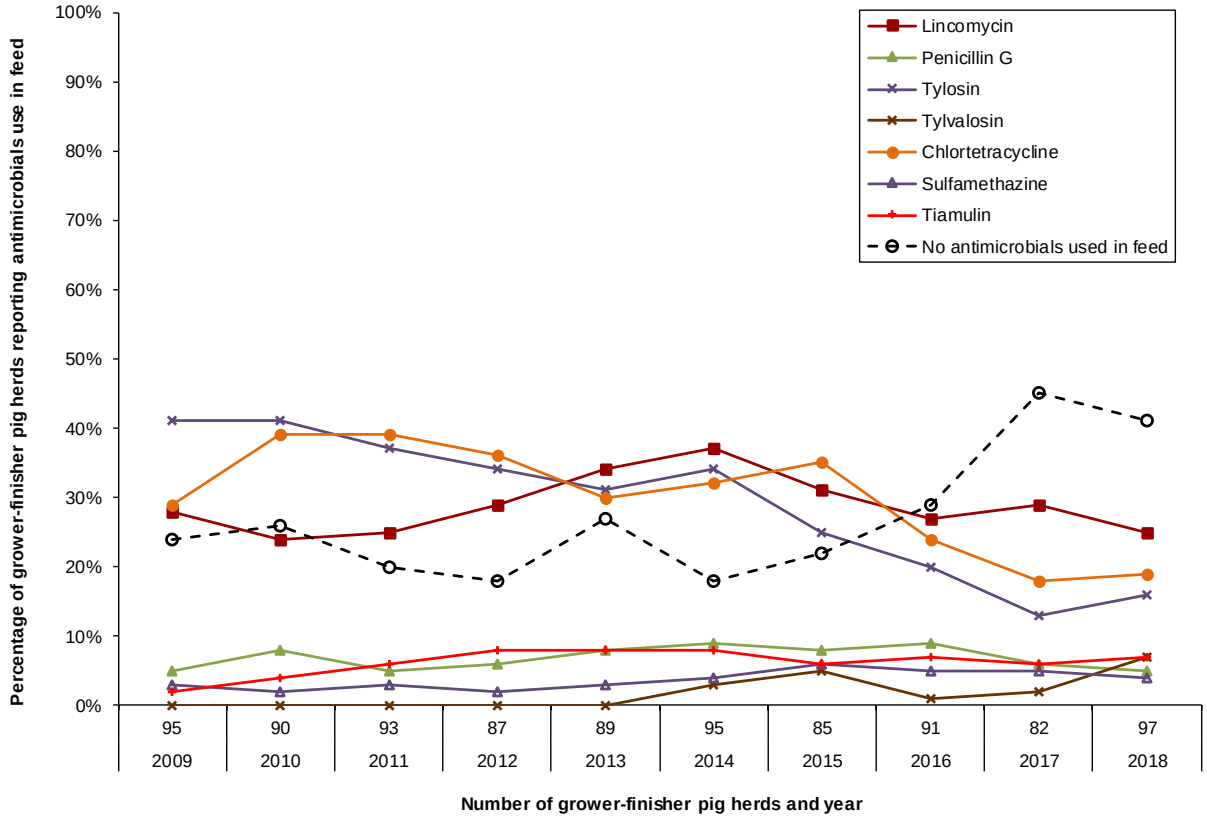
[a] Population correction unit (PCU) or biomass, European weight (total herd population x ESVAC standard pig weight of 65 kilograms).

[b] Percent change = [(current surveillance year – previous surveillance year)/previous surveillance year] x 100.

[c] Includes only the provinces/regions surveyed and includes only the quantity of ionophores used in feed, excluding other antimicrobials.

Antimicrobial use in feed by frequency

Figure 2. 29 Percentage of grower-finisher pig herds reporting antimicrobial use in feed, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of herds	95	90	93	87	89	95	85	91	82	97
Antimicrobial										
II Lincomycin	**28%**	24%	25%	29%	34%	37%	31%	27%	**29%**	**25%**
II Penicillin G	**5%**	8%	5%	6%	8%	9%	8%	9%	**6%**	**5%**
II Tylosin	**41%**	41%	37%	34%	31%	34%	25%	20%	**13%**	**16%**
II Tylvalosin	**0%**	0%	0%	0%	0%	3%	5%	1%	**2%**	**7%**
III Chlortetracycline	**29%**	39%	39%	36%	30%	32%	35%	24%	**18%**	**19%**
III Sulfamethazine	**3%**	2%	3%	2%	3%	4%	6%	5%	**5%**	**4%**
III Tiamulin	**2%**	4%	6%	8%	8%	8%	6%	7%	**6%**	**7%**
No antimicrobials used in feed	**24%**	26%	20%	18%	27%	18%	22%	29%	**45%**	**41%**

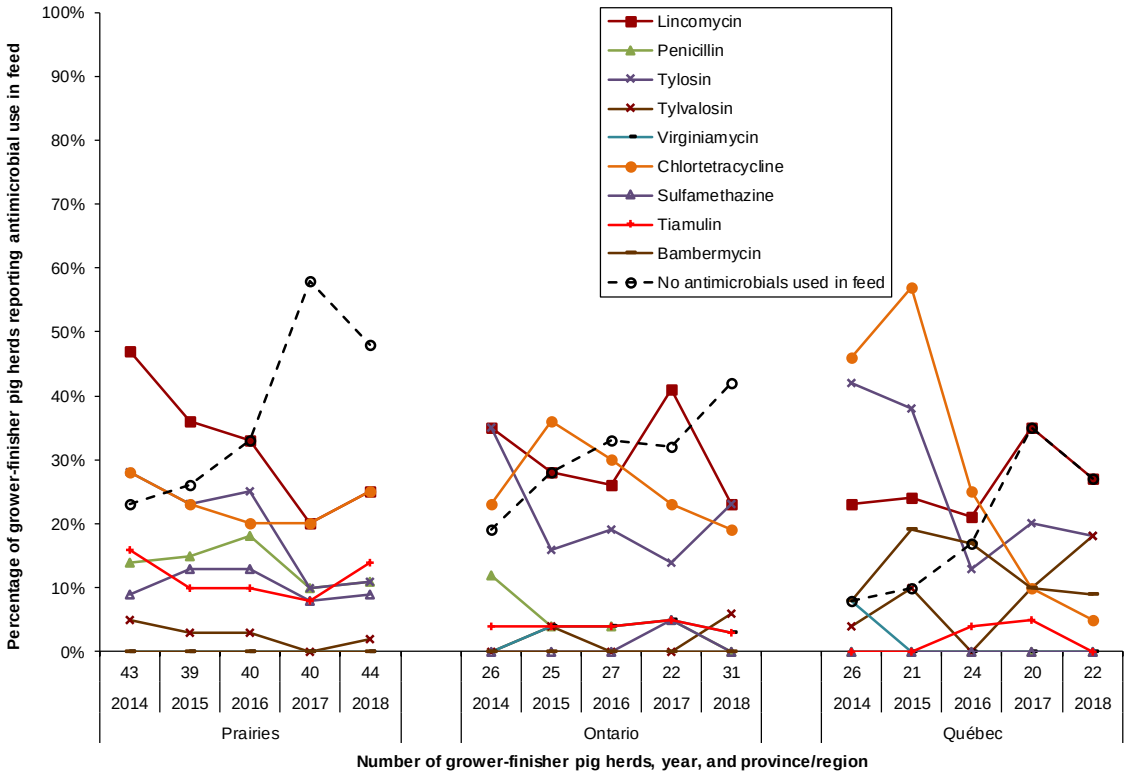
Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

Only antimicrobials used by 5% of herds or more in a given year within any province/region are depicted in this figure. Antimicrobial use in feed reported by fewer than 5% of herds included Category II: tilmicosin, virginiamycin; Category III: bacitracin, neomycin, oxytetracycline, spectinomycin; Category IV: bambermycin.

For the temporal analyses, the proportion (%) of herds using a specific antimicrobial in the current year has been compared to the proportion (%) of herds using the same antimicrobial in the first and previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 2. 30 Percentage of grower-finisher pig herds reporting antimicrobial use in feed by province/region, 2014 to 2018



Number of grower-finisher pig herds, year, and province/region

Province/region		Prairies					Ontario					Québec				
Year		2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Number of herds		43	39	40	40	44	26	25	27	22	31	26	21	24	20	22
Antimicrobial																
	Lincomycin	**47%**	36%	33%	**20%**	**25%**	**35%**	28%	26%	**41%**	**23%**	**23%**	24%	21%	**35%**	**27%**
	Penicillin	**14%**	15%	18%	**10%**	**11%**	**12%**	4%	4%	**5%**	**0%**	**0%**	0%	0%	**0%**	**0%**
II	Tylosin	**28%**	23%	25%	**10%**	**11%**	**35%**	16%	19%	**14%**	**23%**	**42%**	38%	13%	**20%**	**18%**
	Tylvalosin	**5%**	3%	3%	**0%**	**2%**	**0%**	4%	0%	**0%**	**6%**	**4%**	10%	0%	**10%**	**18%**
	Virginiamycin	**0%**	0%	0%	**0%**	**0%**	**0%**	4%	4%	**5%**	**3%**	**8%**	0%	0%	**0%**	**0%**
	Chlortetracycline	**28%**	23%	20%	**20%**	**25%**	**23%**	36%	30%	**23%**	**19%**	**46%**	57%	25%	**10%**	**5%**
III	Sulfamethazine	**9%**	13%	13%	**8%**	**9%**	**0%**	0%	0%	**5%**	**0%**	**0%**	0%	0%	**0%**	**0%**
	Tiamulin	**16%**	10%	10%	**8%**	**14%**	**4%**	4%	4%	**5%**	**3%**	**0%**	0%	4%	**5%**	**0%**
IV	Bambermycin	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**8%**	19%	17%	**10%**	**9%**
	No antimicrobials used in feed	**23%**	26%	33%	**58%**	**48%**	**19%**	28%	33%	**32%**	**42%**	**8%**	10%	17%	**35%**	**27%**

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

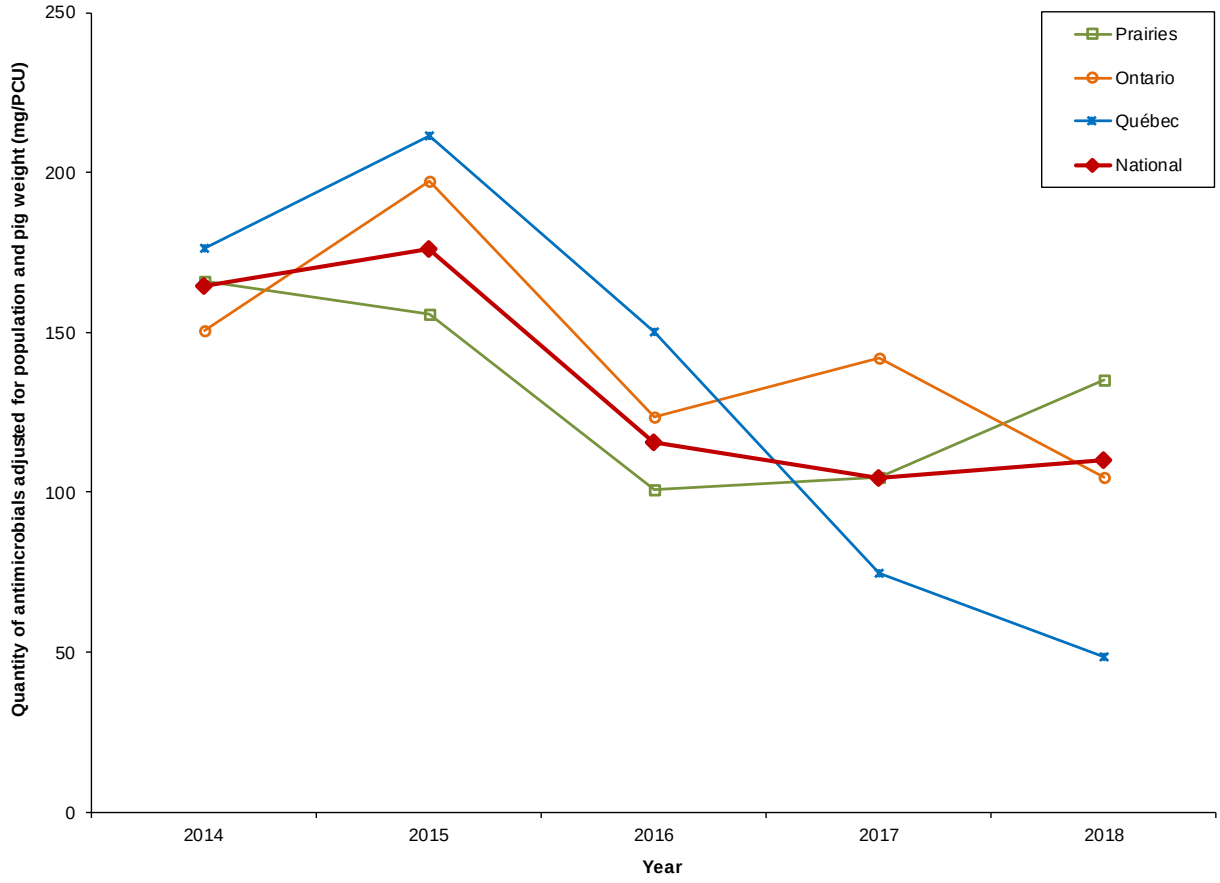
Only antimicrobials used by 5% of herds or more in a given year within any province/region are depicted in this figure. Antimicrobial use in feed reported by fewer than 5% of herds included Category II: tilmicosin; Category III: bacitracin, neomycin, oxytetracycline, and spectinomycin.

For the temporal analyses within province/region, the proportion (%) of herds using a specific antimicrobial in the current year has been compared to the proportion (%) of herds using the same antimicrobial in the first year and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province/region ($P \leq 0.05$) for a given antimicrobial. The presence of red areas indicates significant provincial/regional differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given antimicrobial.

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Antimicrobial use in feed by quantitative indicators

Figure 2. 31 Quantity of antimicrobial use in feed adjusted for population and pig weight (mg/PCU), 2014 to 2018



Year Province/region	2014	2015	2016	2017	2018
Prairies	166	156	101	105	135
Ontario	151	197	123	142	105
Québec	176	211	149	75	48
National	**165**	**176**	**115**	**104**	**110**

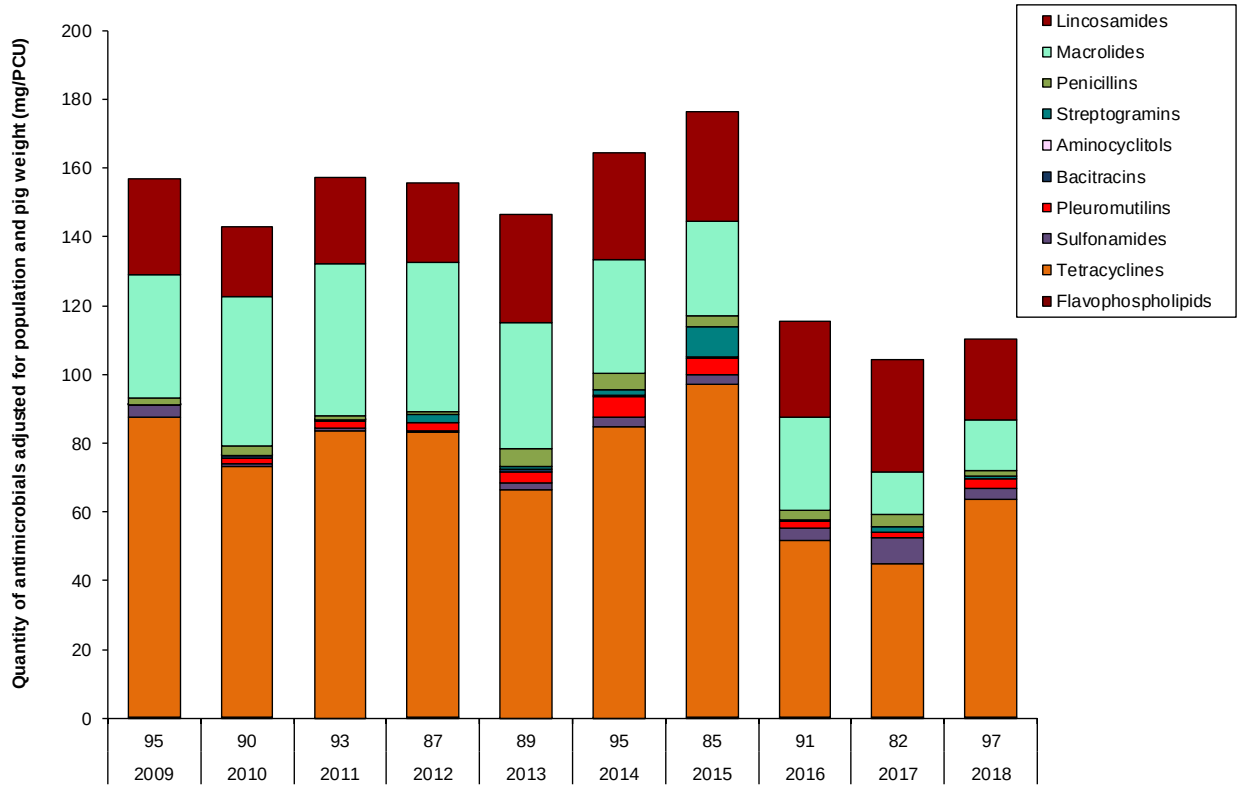
Excluded from this analysis were antimicrobials used for growth promotion and have doses lower than preventive and treatment dosage: bambermycin, narasin and salinomycin.

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to CIPARS 2018: Design and methods.

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 2. 32 Quantity of antimicrobial use in feed, adjusted for population and pig weight (mg/PCU), 2009 to 2018



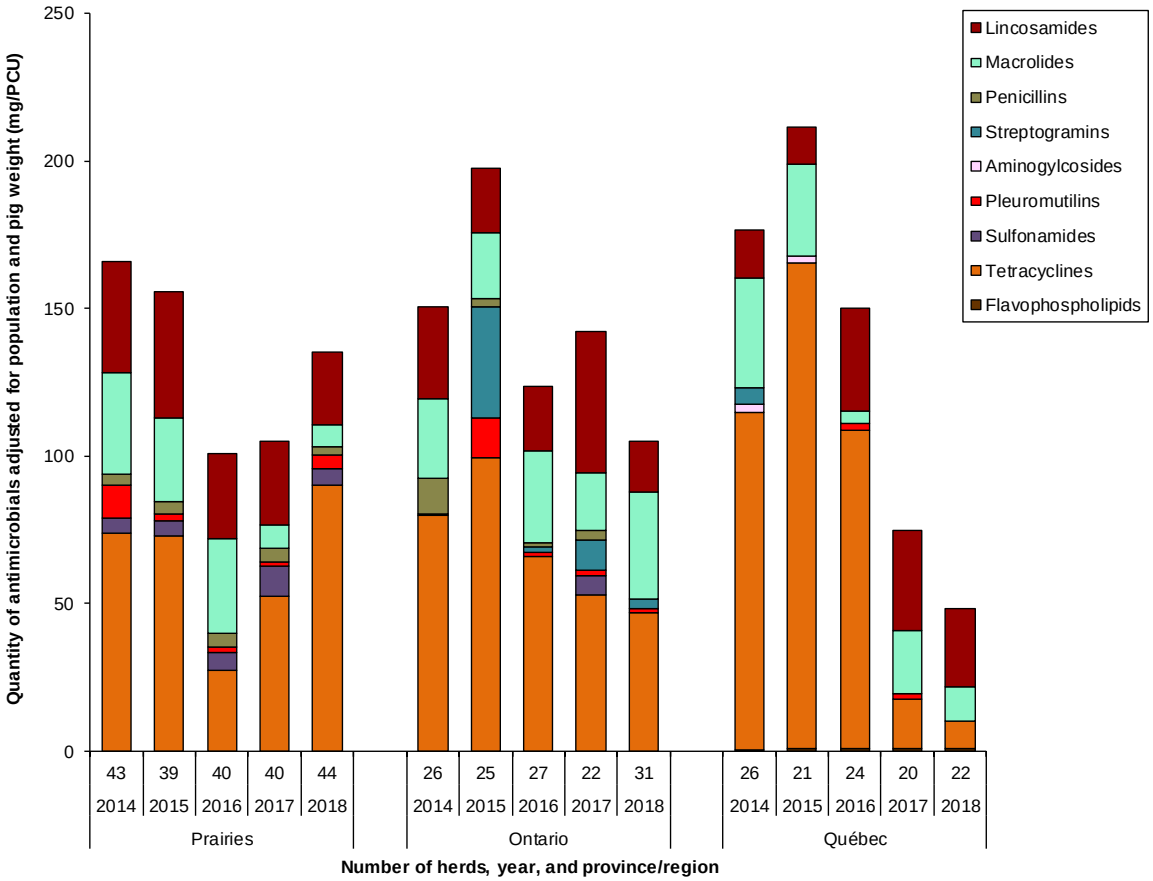
Year Number of herds	2009 95	2010 90	2011 93	2012 87	2013 89	2014 95	2015 85	2016 91	2017 82	2018 97
Antimicrobial class										
II Lincosamides	28.0	20.1	25.1	23.2	31.3	31.1	31.9	28.1	32.6	23.5
II Macrolides	35.9	43.7	44.2	43.3	36.8	33.2	27.3	27.0	12.5	14.8
II Penicillins	2.0	2.5	1.2	0.8	4.9	4.9	3.0	2.9	3.7	1.6
II Streptogramins	< 0.1	< 0.1	< 0.1	2.6	0.8	1.3	9.0	0.4	1.6	0.7
III Aminoglycosides	0.2	0.1	0.4	0.0	0.0	0.6	0.4	0.0	0.0	0.0
III Bacitracins	0.0	0.8	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
III Pleuromutilins	< 0.1	1.7	1.8	2.1	3.2	6.0	4.7	1.9	1.5	2.9
III Sulfonamides	3.3	0.8	0.9	0.5	2.3	2.7	2.7	3.5	7.3	3.2
III Tetracyclines	87.5	73.0	83.6	83.1	66.3	84.7	97.0	51.6	44.9	63.4
IV Flavophospholipids	0.1	0.1	< 0.1	0.1	< 0.1	< 0.1	0.1	0.2	0.2	0.2
Total	**157.1**	**142.9**	**157.2**	**155.7**	**146.4**	**164.6**	**176.3**	**115.5**	**104.3**	**110.2**

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to CIPARS 2018: Design and methods.

Figure 2. 33 Quantity of antimicrobial use in feed, adjusted for population and pig weight (mg/PCU) by province/region, 2014 to 2018



Province/region	Prairies					Ontario					Québec				
Year	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Number of herds	43	39	40	40	44	26	25	27	22	31	26	21	24	20	22
Antimicrobial class															
II Lincosamides	38	43	29	28	25	31	22	21	48	17	16	13	35	34	27
II Macrolides	34	28	32	8	8	27	22	31	20	36	37	31	5	22	12
II Penicillins	4	4	4	5	3	12	3	2	3	0	0	0	0	0	0
II Streptogramins	0	0	0	0	0	0	38	2	10	3	6	0	0	0	0
III Aminoglycosides	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0
III Pleuromutilins	11	3	2	1	5	0	13	1	2	1	0	0	2	2	0
III Sulfonamides	5	5	6	10	6	0	0	0	7	0	0	0	0	0	0
III Tetracyclines	74	73	27	53	90	80	100	66	53	47	114	165	108	17	9
IV Flavophospholipids	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Total	**166**	**156**	**101**	**105**	**135**	**151**	**197**	**123**	**142**	**105**	**176**	**211**	**150**	**75**	**48**

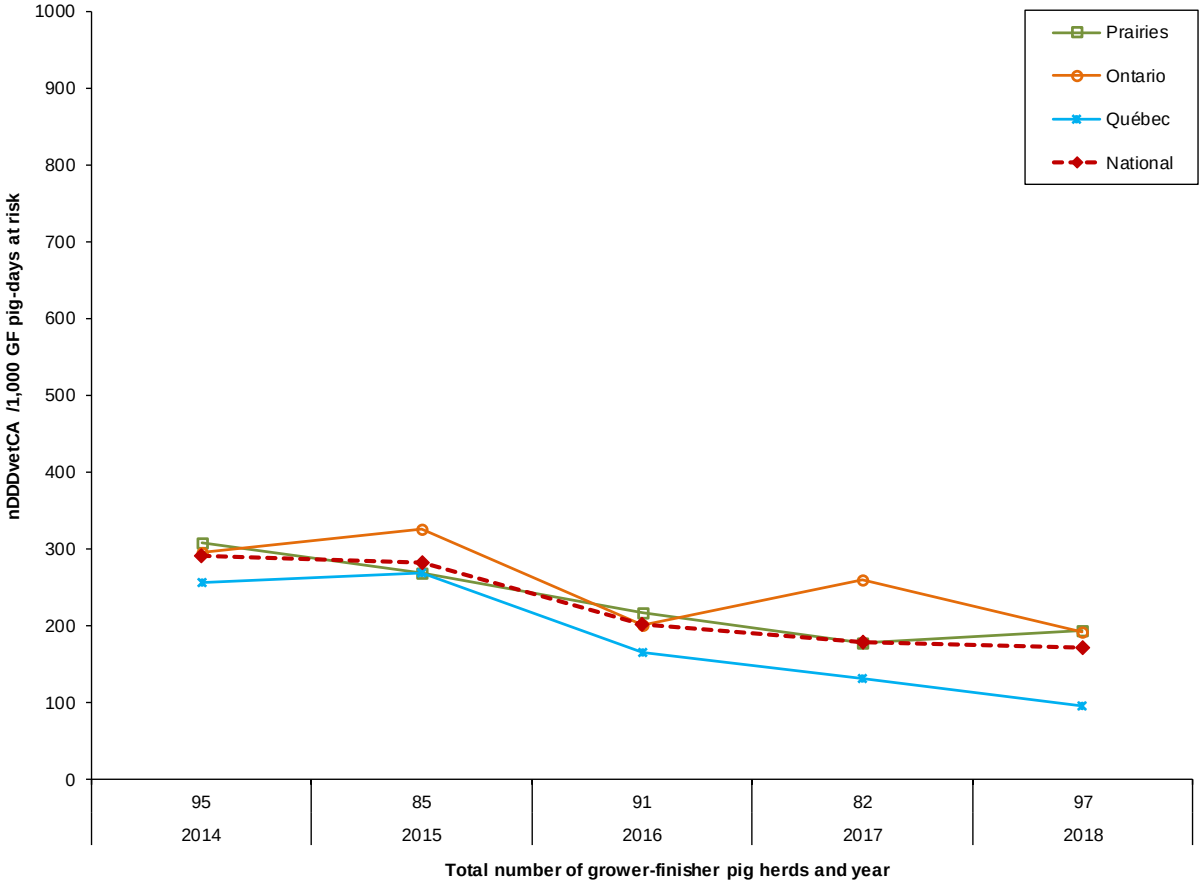
Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 2. 34 Number of Canadian Defined Daily Doses for animals per 1,000 grower-finisher pig-days at risk (nDDDvetCA/1,000 GF pig-days at risk) for antimicrobials administered in feed by province/region, 2014 to 2018



Year Number of herds	2014 95	2015 85	2016 91	2017 82	2018 97
Province/region					
Prairies	308	268	217	177	193
Ontario	294	325	200	259	192
Québec	255	268	164	130	94
National	**290**	**281**	**202**	**178**	**171**

Excluded from this analysis were the ionophores, narasin and slainomycin.

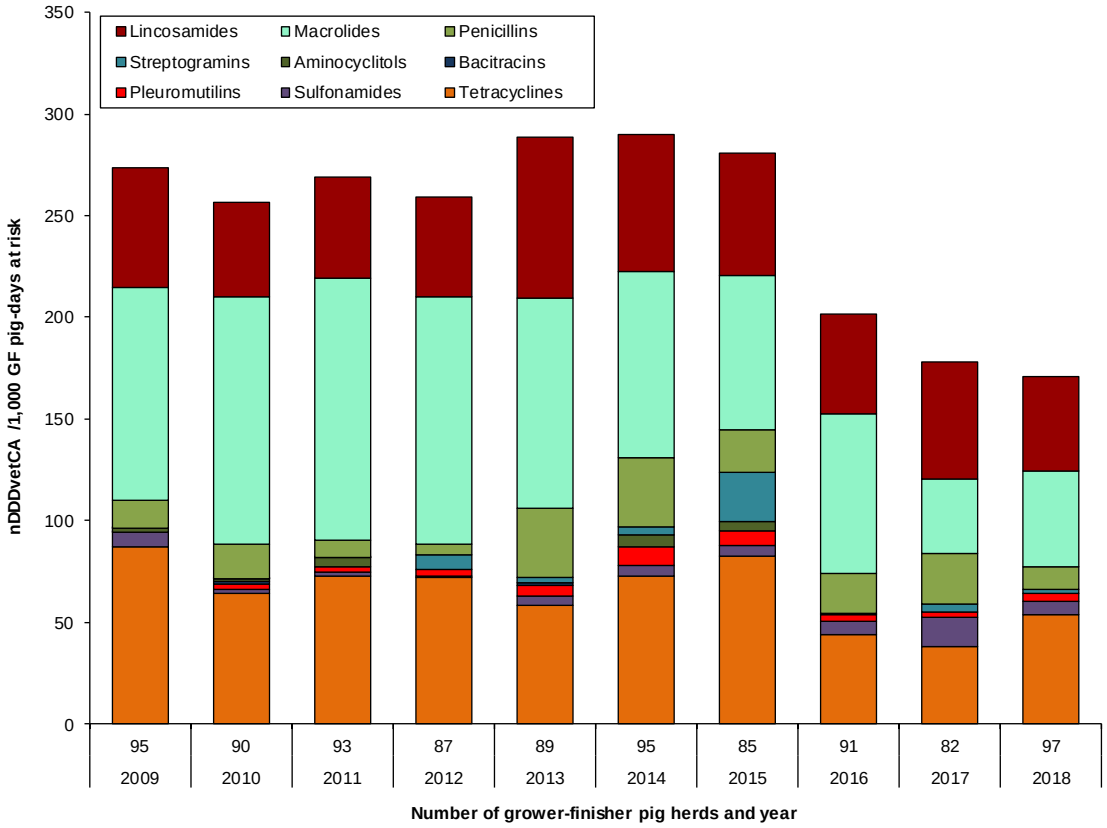
DDDvetCA = Canadian Defined Daily Doses (average labelled dose) in milligrams per kilogram grower-finisher pig weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 2 for the list of standards.

nDDDvetCA/1,000 GF pig-days at risk = number of DDDvetCA/ 1,000 grower-finisher pig-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region and includes the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 2. 35 Number of Canadian Defined Daily Doses for animals per 1,000 grower-finisher pig-days at risk (nDDDvetCA/1,000 GF pig-days at risk) for antimicrobials administered in feed, 2009 to 2018



Year		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of herds		95	90	93	87	89	95	85	91	82	97
Antimicrobial class											
II	Lincosamides	59	47	49	49	79	68	60	49	57	46
	Macrolides	104	122	129	122	103	92	76	78	37	47
	Penicillins	14	17	8	5	35	34	21	20	25	11
	Streptogramins	0	0	0	7	2	4	24	1	4	2
III	Aminocyclitols	2	1	4	0	0	6	4	0	0	0
	Bacitracins	0	2	0	0	2	0	0	0	0	0
	Pleuromutilins	0	3	3	3	5	9	7	3	2	4
	Sulfonamides	7	2	2	1	5	5	5	7	15	6
	Tetracyclines	87	64	73	72	58	72	82	44	38	54
Total		**274**	**257**	**269**	**259**	**289**	**290**	**281**	**202**	**178**	**171**

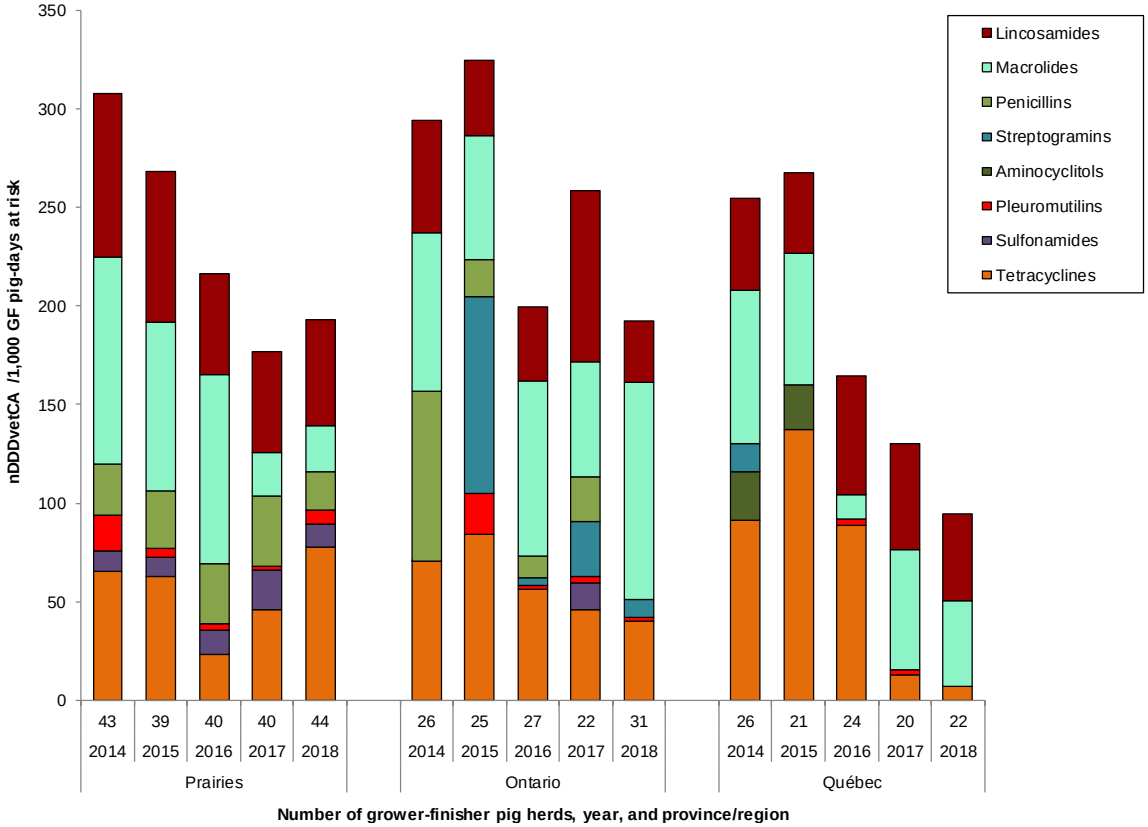
Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

DDDvetCA = Canadian Defined Daily Doses (average labelled dose) in milligrams per kilogram grower-finisher pig weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 2 for the list of standards.

nDDDvetCA/1,000 GF pig-days at risk = number of DDDvetCA/ 1,000 grower-finisher pig-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Figure 2. 36 Number of Canadian Defined Daily Doses for animals per 1,000 grower-finisher pig-days at risk (nDDDvetCA/1,000 GF pig-days at risk) for antimicrobials administered in feed by province/region, 2014 to 2018



Province/region		Prairies					Ontario					Québec				
Year		2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Number of herds		43	39	40	40	44	26	25	27	22	31	26	21	24	20	22
Antimicrobial class																
II	Lincosamides	83	77	52	52	53	57	38	38	87	31	47	41	60	54	44
	Macrolides	105	85	96	22	24	80	63	89	58	110	78	67	13	61	43
	Penicillins	26	29	30	35	20	86	19	11	23	0	0	0	0	0	0
	Streptogramins	0	0	0	0	0	0	100	4	28	9	15	0	0	0	0
III	Aminocyclitols	0	0	0	0	0	0	0	0	0	0	25	23	0	0	0
	Pleuromutilins	18	4	3	2	7	0	21	2	3	2	0	0	3	3	0
	Sulfonamides	11	10	12	20	11	0	0	0	13	0	0	0	0	0	0
	Tetracyclines	65	63	23	46	78	70	84	56	46	40	91	137	89	13	7
Total		**308**	**268**	**217**	**177**	**193**	**294**	**325**	**200**	**259**	**192**	**255**	**268**	**164**	**130**	**94**

Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

DDDvetCA = Canadian Defined Daily Doses (average labelled dose) in milligrams per kilogram grower-finisher pig weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 2 for the list of standards.

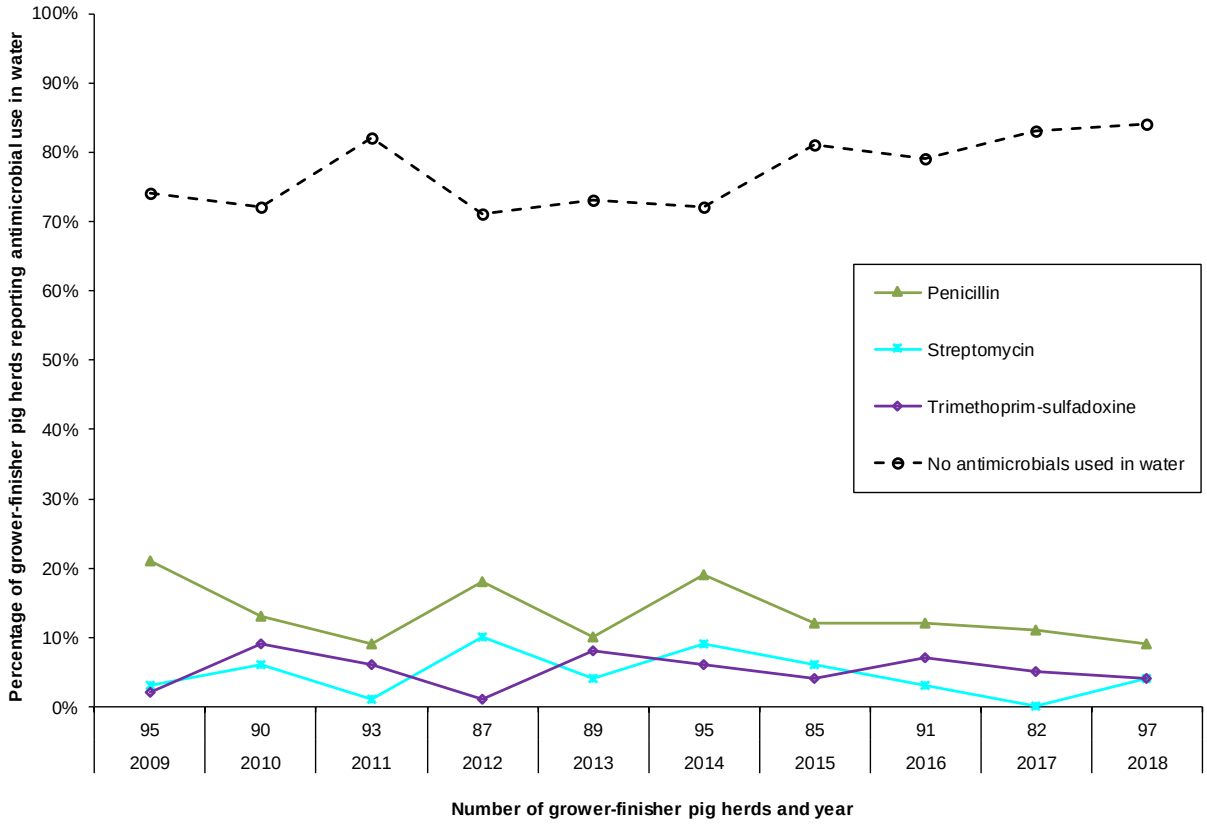
nDDDvetCA/1,000 GF pig-days at risk = number of DDDvetCA/ 1,000 grower-finisher pig-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region including the provinces of Alberta, Saskatchewan and Manitoba.

Antimicrobial use in water by frequency

Figure 2. 37 Percentage of grower-finisher pig herds reporting antimicrobial use in water, 2009 to 2018



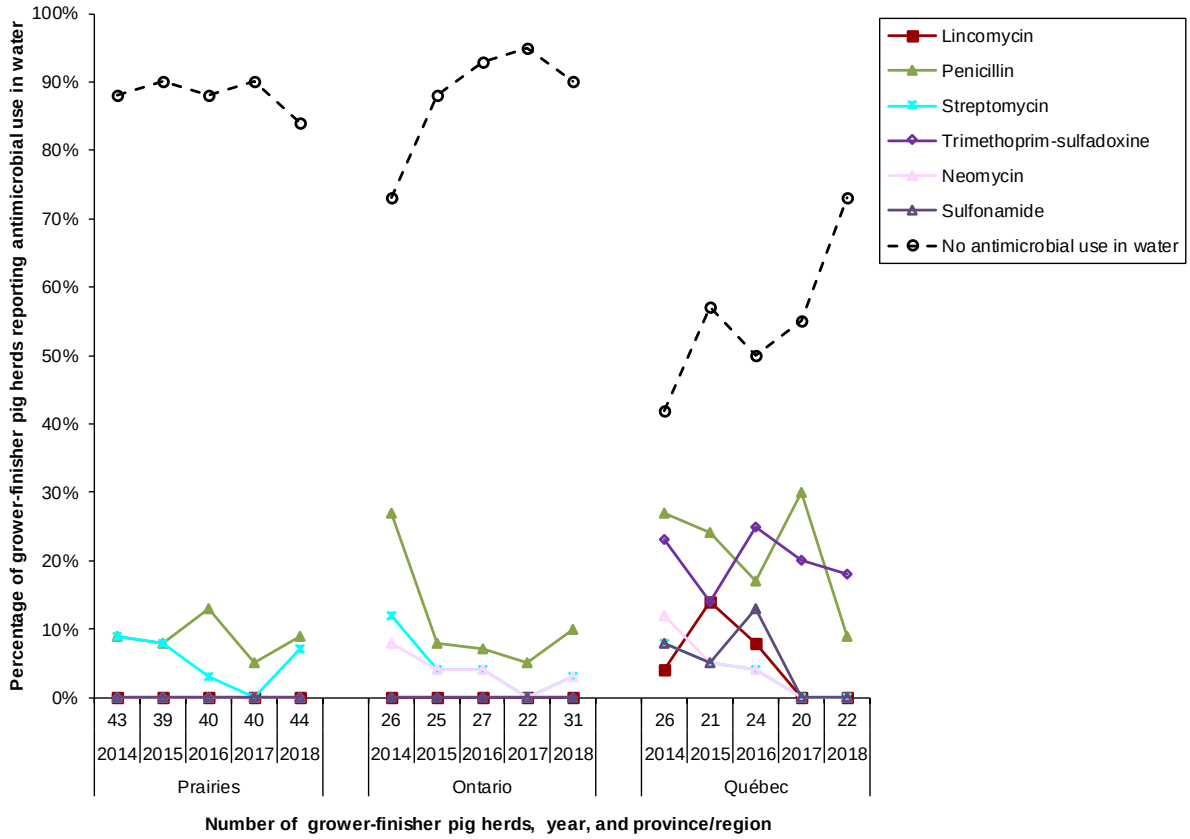
Year Number of herds	2009 95	2010 90	2011 93	2012 87	2013 89	2014 95	2015 85	2016 91	2017 82	2018 97
Antimicrobial										
Penicillin	**21%**	13%	9%	18%	10%	19%	12%	12%	**11%**	**9%**
II Streptomycin	**3%**	6%	1%	10%	4%	9%	6%	3%	**0%**	**4%**
Trimethoprim-sulfadoxine	**2%**	9%	6%	1%	8%	6%	4%	7%	**5%**	**4%**
No antimicrobials used in water	**74%**	72%	82%	71%	73%	72%	81%	79%	**83%**	**84%**

Roman numerals II indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure. Antimicrobial use in water reported by fewer than 5% of herds included Category II: lincomycin; Category III: neomycin, spectinomycin, sulfonamides, and tetracycline.

For the temporal analyses, the proportion (%) of herds using a specific antimicrobial in the current year has been compared to the proportion (%) of herds using the same antimicrobial in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

Figure 2. 38 Percentage of grower-finisher pig herds reporting antimicrobial use in water by province/region, 2014 to 2018



Province/region		Prairies					Ontario					Québec				
Year		2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Number of herds		43	39	40	40	44	26	25	27	22	31	26	21	24	20	22
Antimicrobial																
II	Lincomycin	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**4%**	14%	8%	**0%**	**0%**
II	Penicillin	**9%**	8%	13%	**5%**	**9%**	**27%**	8%	7%	**5%**	**10%**	**27%**	24%	17%	**30%**	**9%**
II	Streptomycin	**9%**	8%	3%	**0%**	**7%**	**12%**	4%	4%	**0%**	**3%**	**8%**	5%	4%	**0%**	**0%**
II	Trimethoprim-sulfadoxine	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**23%**	14%	25%	**20%**	**18%**
III	Neomycin	**0%**	0%	0%	**0%**	**0%**	**8%**	4%	4%	**0%**	**3%**	**12%**	5%	4%	**0%**	**0%**
III	Sulfonamide	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**8%**	5%	13%	**0%**	**0%**
	No antimicrobial use in water	**88%**	90%	88%	**90%**	**84%**	**73%**	88%	93%	**95%**	**90%**	**42%**	57%	50%	**55%**	**73%**

Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure. Antimicrobial use in water reported by fewer than 5% of herds included Category III: spectinomycin and tetracycline.

For the temporal analyses within province/region, the proportion (%) of herds using a specific antimicrobial in the current year has been compared to the proportion (%) of herds using the same antimicrobial in the first year and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province/region ($P \leq 0.05$) for a given antimicrobial. The presence of red areas indicates significant provincial/regional differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given antimicrobial.

The Prairies is a region including the provinces of Alberta, Saskatchewan and Manitoba.

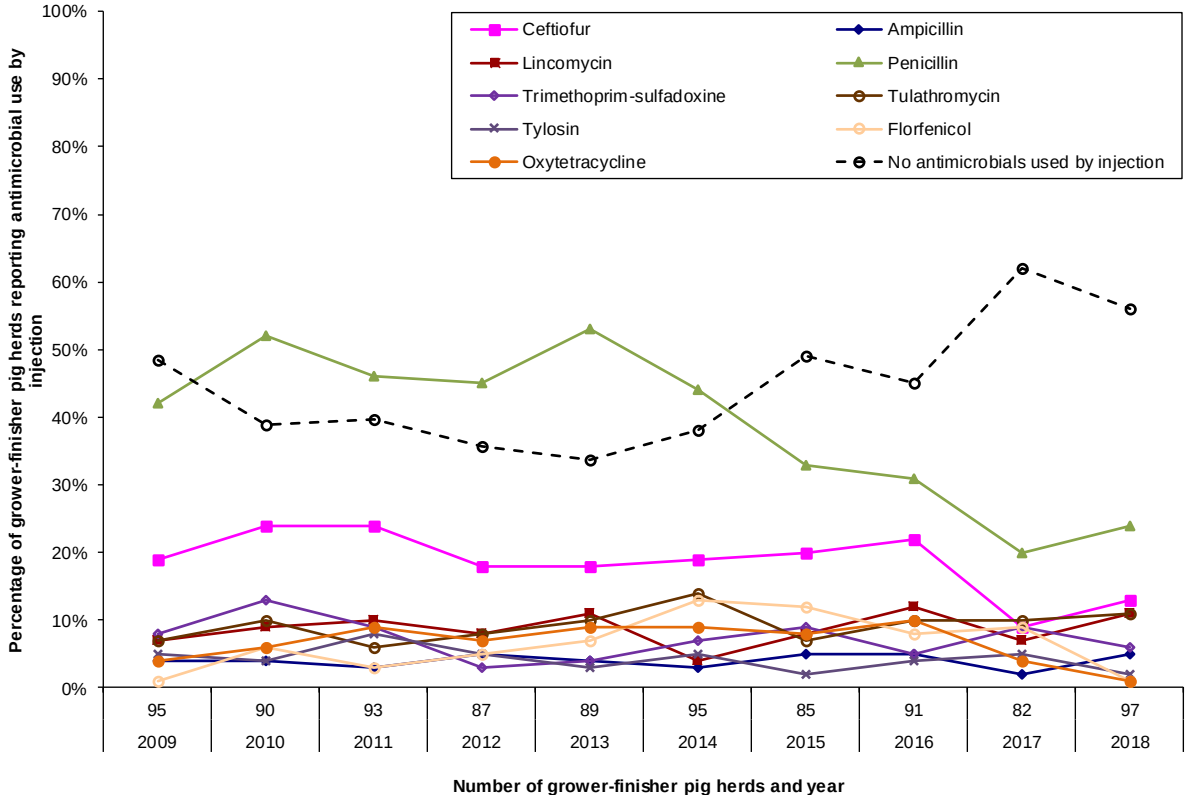
Antimicrobial use in water by quantitative indicators

Number of Canadian Defined Daily Doses for animals per 1,000 grower-finisher pig-days at risk (nDDDvetCA/1,000 GF pig-days at risk) for antimicrobials administered in water, 2017 to 2018

Data available upon request.

Antimicrobial use by injection by frequency

Figure 2. 39 Percentage of grower-finisher pig herds reporting antimicrobial use by injection, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of herds	95	90	93	87	89	95	85	91	82	97
Antimicrobial										
I Ceftiofur	**20%**	24%	24%	18%	18%	19%	20%	22%	**9%**	**13%**
II Ampicillin	**4%**	4%	3%	5%	4%	3%	5%	5%	**2%**	**5%**
II Lincomycin	**8%**	9%	10%	8%	11%	4%	8%	12%	**7%**	**11%**
II Penicillin	**41%**	51%	46%	45%	53%	44%	33%	31%	**20%**	**24%**
II Trimethoprim-sulfadoxine	**9%**	13%	9%	3%	4%	7%	9%	5%	**9%**	**6%**
II Tulathromycin	**8%**	10%	6%	8%	10%	14%	7%	10%	**10%**	**11%**
II Tylosin	**5%**	4%	8%	5%	3%	5%	2%	4%	**5%**	**2%**
III Florfenicol	**1%**	6%	3%	5%	7%	13%	12%	8%	**9%**	**1%**
III Oxytetracycline	**4%**	6%	9%	7%	9%	9%	8%	10%	**4%**	**1%**
No antimicrobials used by injection	**47%**	40%	40%	36%	34%	38%	49%	45%	**62%**	**56%**

See corresponding footnotes on next page.

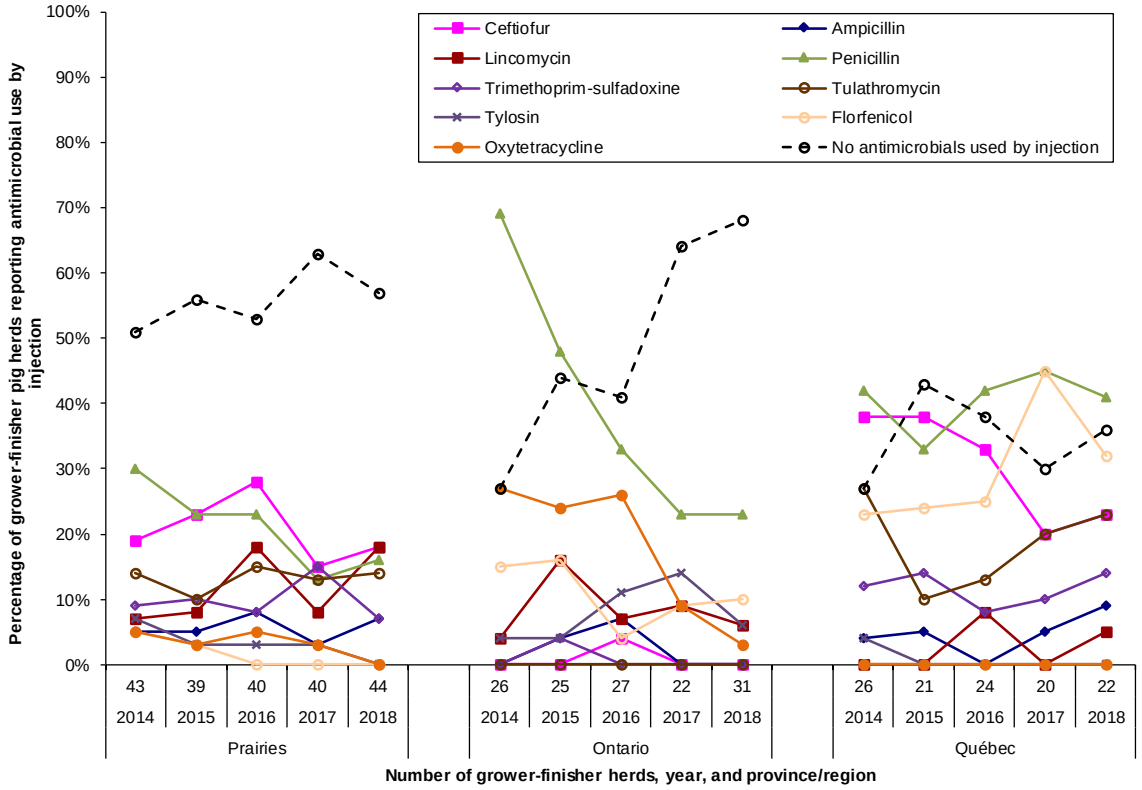
Figure 2. 39 Percentage of grower-finisher pig herds reporting antimicrobial use by injection, 2009 to 2018 (continued)

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure. Antimicrobial use by injection reported by fewer than 5% of herds included Category II: erythromycin; Category III: spectinomycin and tiamulin.

For the temporal analyses, the proportion (%) of herds using a specific antimicrobial in the current year has been compared to the proportion (%) of herds using the same antimicrobial in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

Figure 2. 40 Percentage of grower-finisher pig herds reporting antimicrobial use by injection, by province/region, 2014 to 2018



Province/region	Prairies					Ontario					Québec				
Year	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Number of herds	43	39	40	40	44	26	25	27	22	31	26	21	24	20	22
Antimicrobial															
I Ceftiofur	**19%**	23%	28%	**15%**	**18%**	**0%**	0%	4%	**0%**	**0%**	**38%**	38%	33%	**20%**	**23%**
II Ampicillin	**5%**	5%	8%	**3%**	**7%**	**0%**	4%	7%	**0%**	**0%**	**4%**	5%	0%	**5%**	**9%**
II Lincomycin	**7%**	8%	18%	**8%**	**18%**	**4%**	16%	7%	**9%**	**6%**	**0%**	0%	8%	**0%**	**5%**
II Penicillin	**30%**	23%	23%	**13%**	**16%**	**69%**	48%	33%	**23%**	**23%**	**42%**	33%	42%	**45%**	**41%**
II Trimethoprim-sulfadoxine	**9%**	10%	8%	**15%**	**7%**	**0%**	4%	0%	**0%**	**0%**	**12%**	14%	8%	**10%**	**14%**
II Tulathromycin	**14%**	10%	15%	**13%**	**14%**	**0%**	0%	0%	**0%**	**0%**	**27%**	10%	13%	**20%**	**23%**
II Tylosin	**7%**	3%	3%	**3%**	**0%**	**4%**	4%	11%	**14%**	**6%**	**4%**	0%	0%	**0%**	**0%**
III Florfenicol	**5%**	3%	0%	**0%**	**0%**	**15%**	16%	4%	**9%**	**10%**	**23%**	24%	25%	**45%**	**32%**
III Oxytetracycline	**5%**	3%	5%	**3%**	**0%**	**27%**	24%	26%	**9%**	**3%**	**0%**	0%	0%	**0%**	**0%**
No antimicrobials used by injection	**51%**	56%	53%	**63%**	**57%**	**27%**	44%	41%	**64%**	**68%**	**27%**	43%	38%	**30%**	**36%**

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

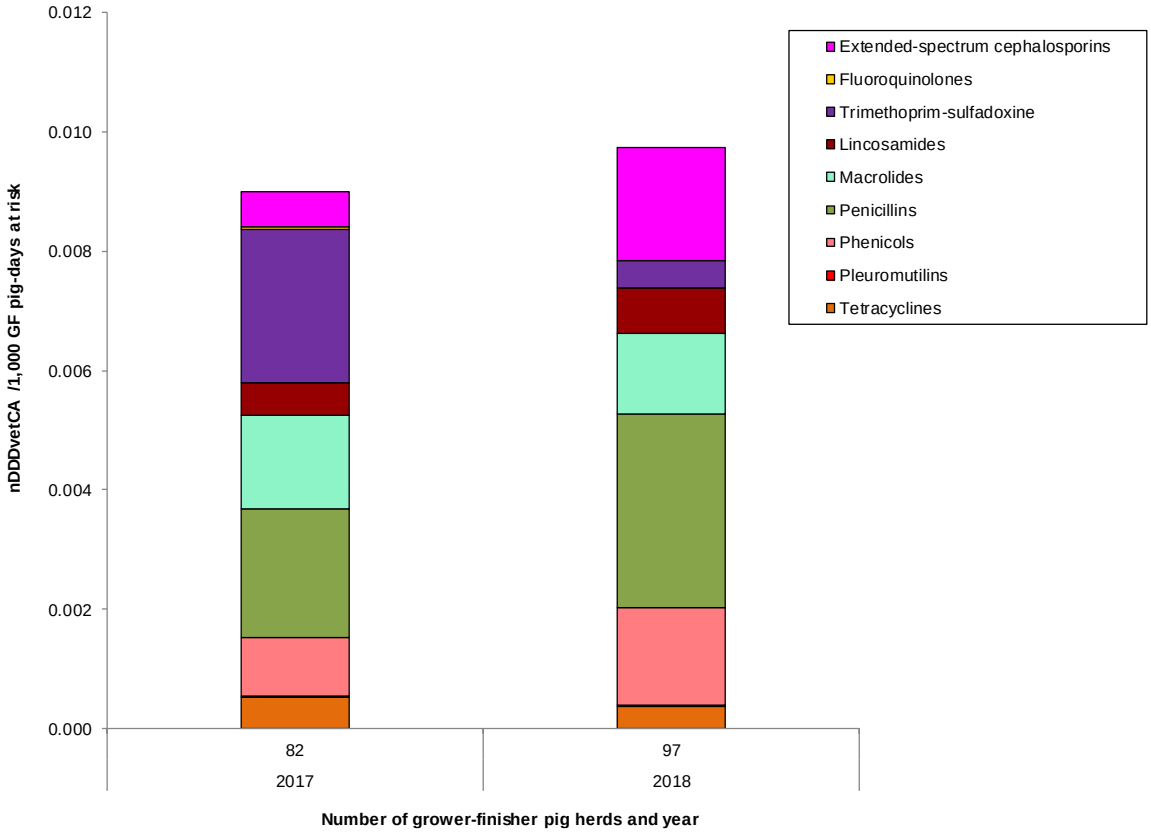
Only antimicrobials used by 5% of herds or more in a given year within any province/region are depicted in this figure. Antimicrobial use by injection reported by fewer than 5% of herds included Category II: erythromycin; Category III: spectinomycin and tiamulin.

For the temporal analyses within province/region, the proportion (%) of herds using a specific antimicrobial in the current year has been compared to the proportion (%) of herds using the same antimicrobial in the first year and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province/region ($P \leq 0.05$) for a given antimicrobial. The presence of red areas indicates significant provincial/regional differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given antimicrobial.

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Antimicrobial use by injection by quantitative indicators

Figure 2. 41 Number of Canadian Defined Daily Doses for animals per 1,000 grower-finisher pig-days at risk (nDDDvetCA/1,000 GF pig-days at risk) for antimicrobials administered by injection, 2017 to 2018



Year		2017	2018
Number of herds		82	97
Antimicrobial class			
I	Extended-spectrum cephalosporins	0.000594	0.001909
	Fluoroquinolones	0.000050	0.000000
II	Trimethoprim-sulfadoxine	0.002575	0.000446
	Lincosamides	0.000550	0.000772
	Macrolides	0.001560	0.001352
	Penicillins	0.002155	0.003253
III	Phenicols	0.000979	0.001628
	Pleuromutilins	0.000019	0.000009
	Tetracyclines	0.000531	0.000379
Total		**0.008995**	**0.009739**

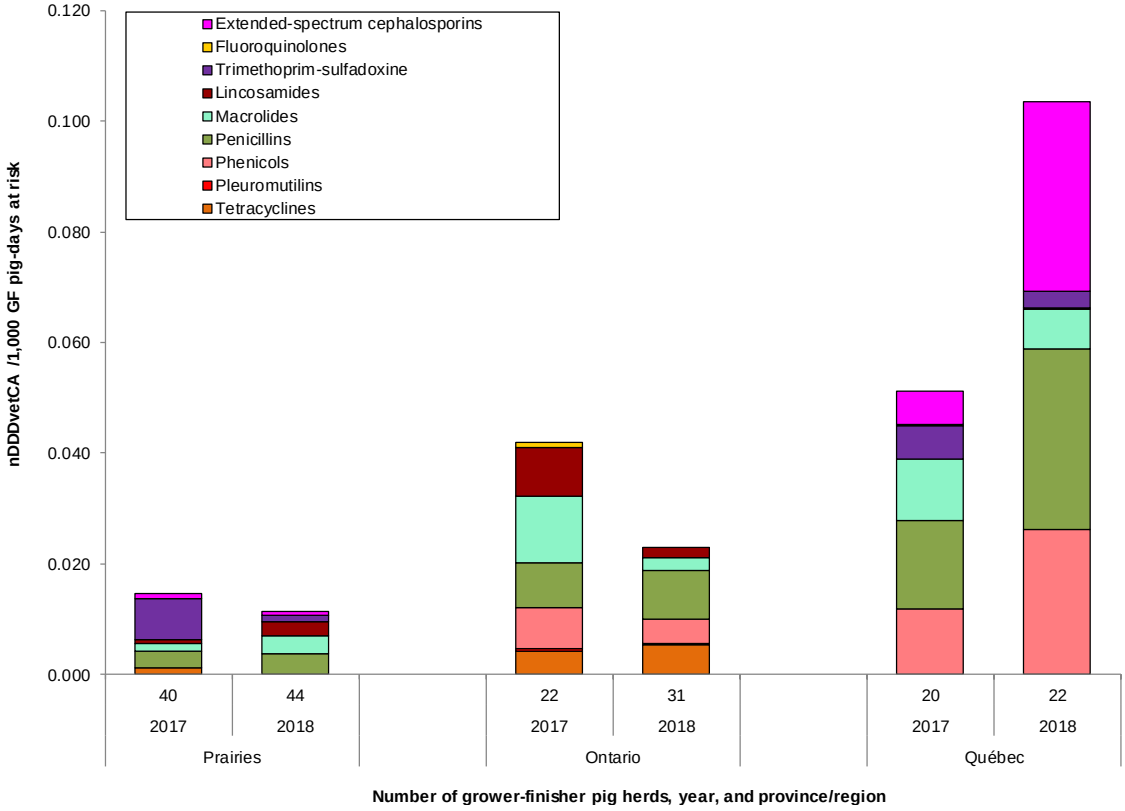
Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

DDDvetCA = Canadian Defined Daily Doses (average labelled dose) in milligrams per kilogram grower-finisher pig weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 2 for the list of standards.

nDDDvetCA/1,000 GF pig-days at risk = number of DDDvetCA/ 1,000 grower-finisher pig-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Figure 2. 42 Number of Canadian Defined Daily Doses for animals per 1,000 grower-finisher pig-days at risk (nDDDvetCA/1,000 GF pig-days at risk) for antimicrobials administered by injection, by province/region, 2017 to 2018



Province/region		Prairies		Ontario		Québec	
Year		2017	2018	2017	2018	2017	2018
Number of herds		40	44	22	31	20	22
Antimicrobial class							
I	Extended-spectrum cephalosporins	0.000846	0.000682	0.000000	0.000000	0.005987	0.034203
	Fluoroquinolones	0.000000	0.000000	0.000891	0.000000	0.000249	0.000000
II	Trimethoprim-sulfadoxine	0.007475	0.001186	0.000000	0.000000	0.005916	0.002868
	Lincosamides	0.000629	0.002518	0.008915	0.001745	0.000000	0.000260
	Macrolides	0.001467	0.003260	0.011875	0.002239	0.011227	0.007315
	Penicillins	0.003056	0.003829	0.008152	0.008982	0.015975	0.032685
III	Phenicols	0.000000	0.000000	0.007489	0.004344	0.011854	0.026113
	Pleuromutilins	0.000000	0.000000	0.000477	0.000128	0.000000	0.000000
	Tetracyclines	0.001206	0.000000	0.004185	0.005458	0.000000	0.000000
Total		**0.014679**	**0.011474**	**0.041507**	**0.022768**	**0.051208**	**0.103445**

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

DDDvetCA = Canadian Defined Daily Doses (average labelled dose) in milligrams per kilogram grower-finisher pig weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 2 for the list of standards.

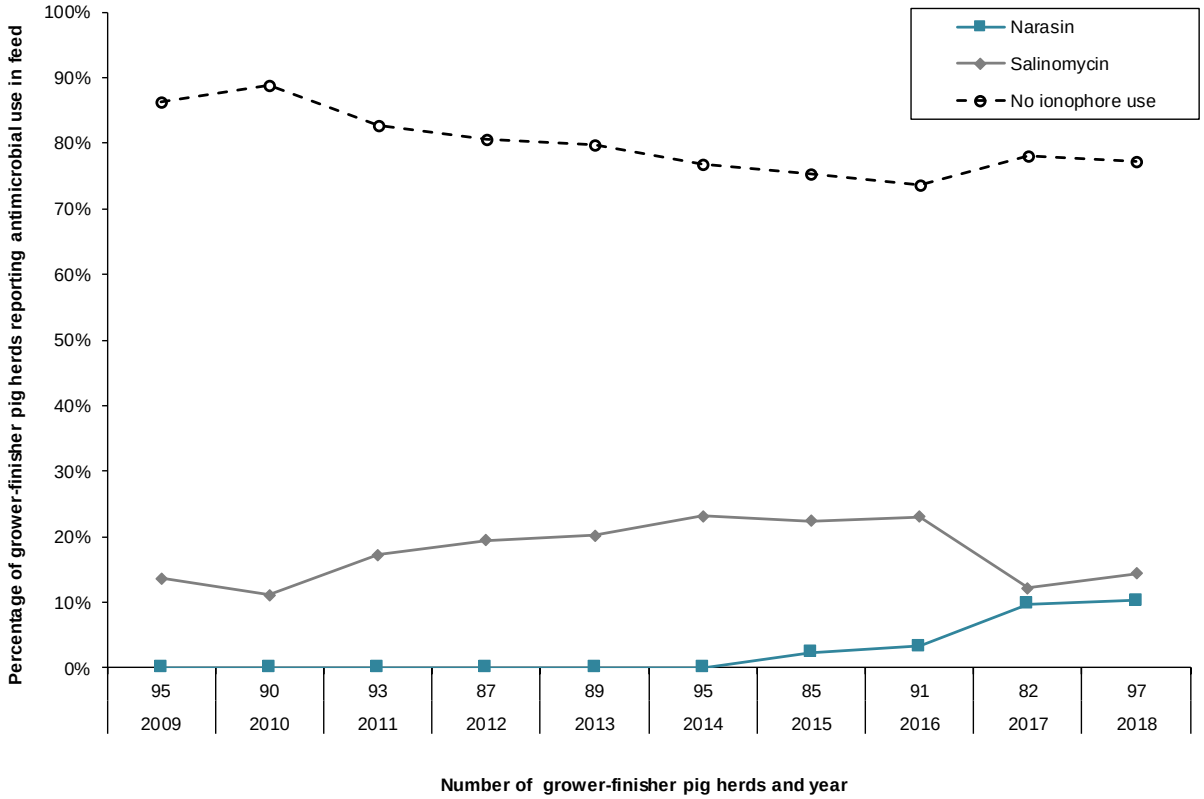
nDDDvetCA/1,000 GF pig-days at risk = number of DDDvetCA/ 1,000 grower-finisher pig-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

The Prairies is a region including the provinces of Alberta, Saskatchewan and Manitoba.

Coccidiostat use in feed by frequency

Figure 2. 43 Percentage of grower-finisher pig herds reporting ionophore coccidiostat use in feed, 2009 to 2018

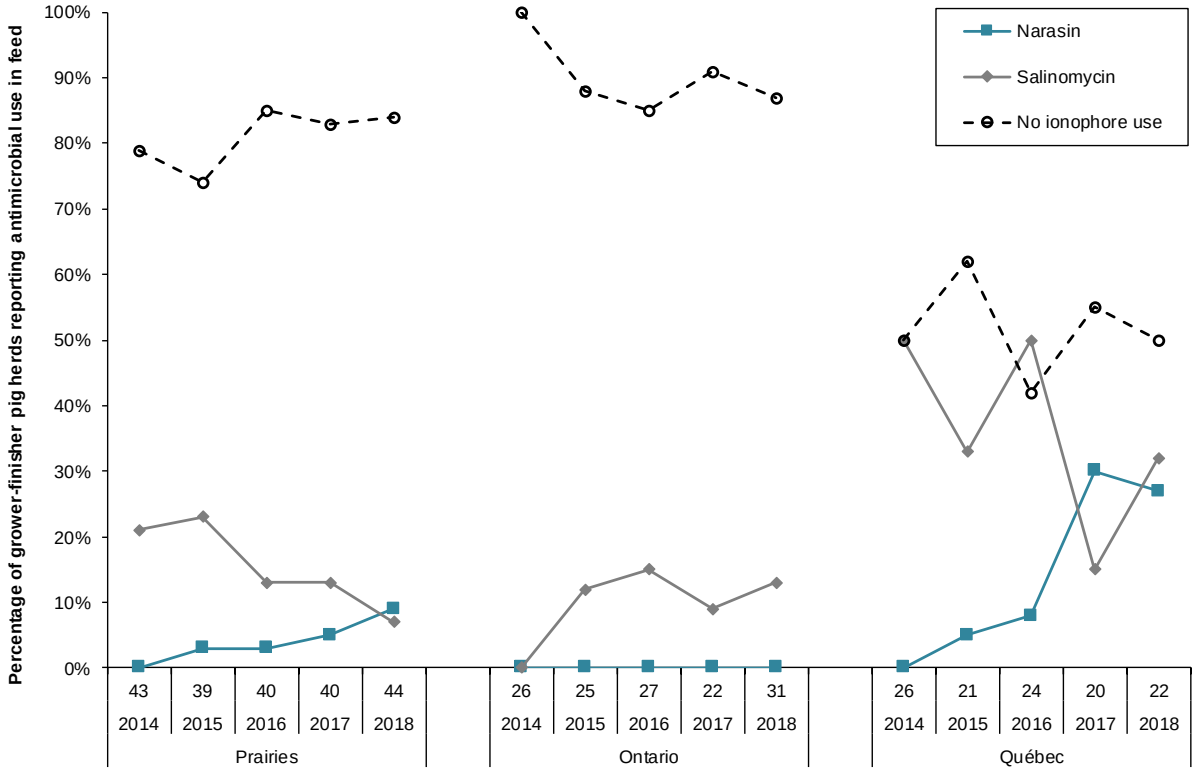


Year Number of herds		2009 95	2010 90	2011 93	2012 87	2013 89	2014 95	2015 85	2016 91	2017 82	2018 97
Antimicrobial											
IV	Narasin	**0%**	0%	0%	0%	0%	0%	2%	3%	**10%**	**10%**
	Salinomycin	**14%**	11%	17%	20%	20%	23%	22%	23%	**12%**	**14%**
	No ionophore use in feed	**86%**	89%	83%	81%	80%	77%	75%	74%	**78%**	**77%**

Roman numeral IV indicates the ranking of antimicrobials based on importance to human medicine as outlined by the Veterinary Drugs Directorate.

For the temporal analyses, the proportion (%) of herds using a specific ionophore in the current year has been compared to the proportion (%) of herds using the same ionophore in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given ionophore.

Figure 2. 44 Percentage of grower-finisher pig herds reporting ionophore coccidiostat use in feed, by province/region, 2014 to 2018



Number of grower-finisher pig herds, year, and province/region

Province/region		Prairies					Ontario					Québec				
Year		2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Number of herds		43	39	40	40	44	26	25	27	22	31	26	21	24	20	22
Coccidiostat																
IV	Narasin	**0%**	3%	3%	**5%**	**9%**	**0%**	0%	0%	**0%**	**0%**	**0%**	5%	8%	**30%**	**27%**
	Salinomycin	**21%**	23%	13%	**13%**	**7%**	**0%**	12%	15%	**9%**	**13%**	**50%**	33%	50%	**15%**	**32%**
	No ionophore use in feed	**79%**	74%	85%	**83%**	**84%**	**100%**	88%	85%	**91%**	**87%**	**50%**	62%	42%	**55%**	**50%**

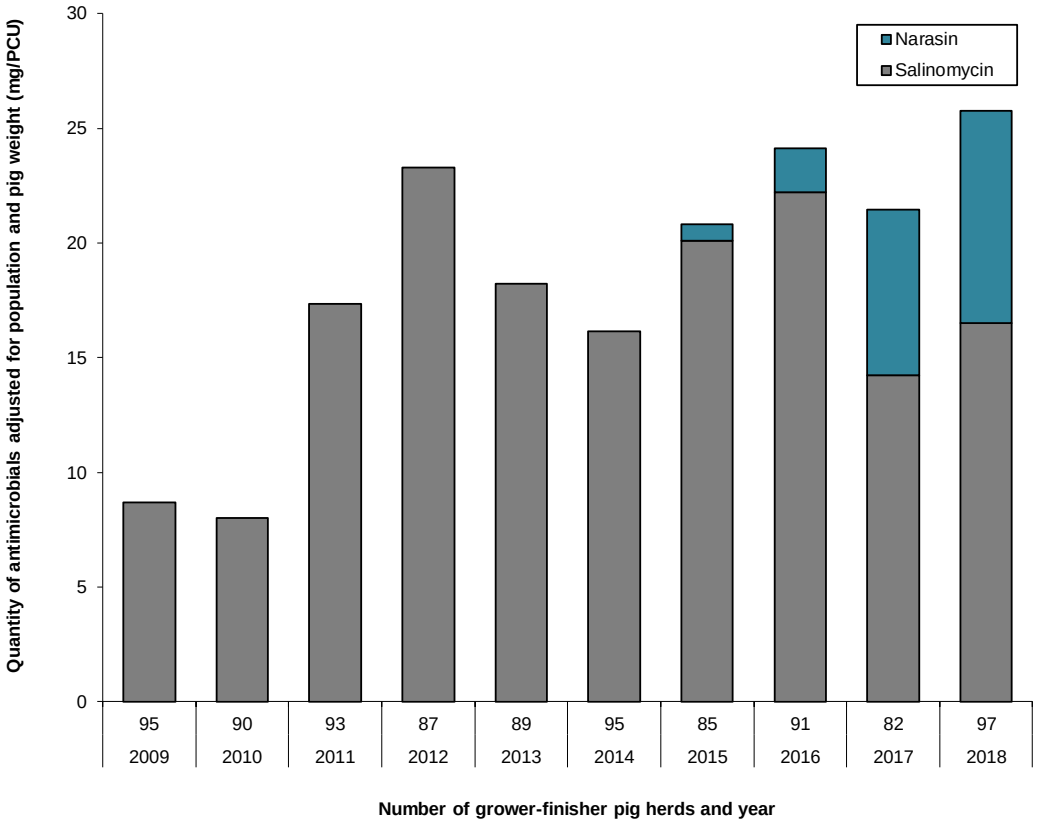
Roman numeral IV indicates the ranking of antimicrobials based on importance to human medicine as outlined by the Veterinary Drugs Directorate.

For the temporal analyses within province/region, the proportion (%) of herds using a specific ionophore in the current year has been compared to the proportion (%) of herds using the same antimicrobial in the first year and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province/region ($P \leq 0.05$) for a given ionophore. The presence of red areas indicates significant provincial/regional differences ($P \leq 0.05$) for a given ionophore within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given ionophore.

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Coccidiostat use in feed by quantitative indicators

Figure 2. 45 Quantity of ionophore coccidiostat use in feed, adjusted for population and pig weight (mg/PCU), 2009 to 2018



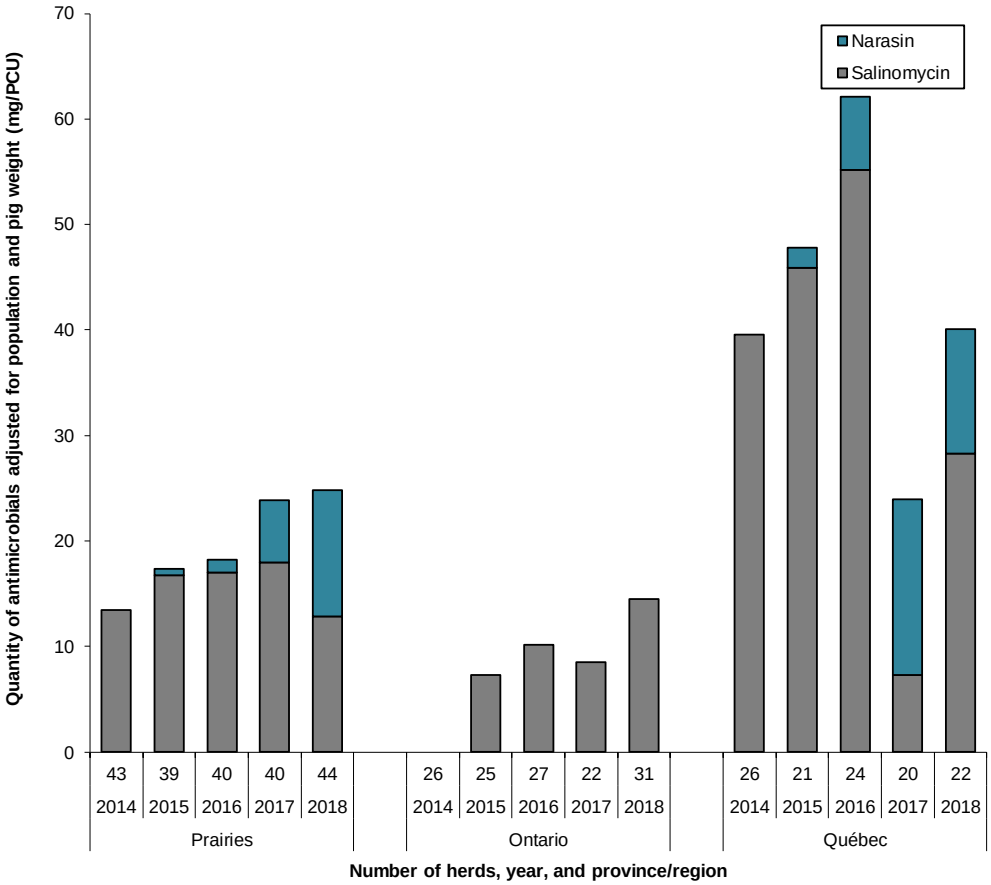
Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of herds	95	90	93	87	89	95	85	91	82	97
Coccidiostat										
IV Narasin	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.9	7.2	9.3
Salinomycin	8.7	8.0	17.3	23.3	18.2	16.2	20.1	22.2	14.2	16.5
Total	**8.7**	**8.0**	**17.3**	**23.3**	**18.2**	**16.2**	**20.8**	**24.1**	**21.5**	**25.8**

Roman numerals IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to CIPARS 2018: Design and methods.

Figure 2. 46 Quantity of ionophore coccidiostat use in feed, adjusted for population and pig weight (mg/PCU), by province/region, 2014 to 2018



Province/region	Prairies					Ontario					Québec				
Year	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Number of herds	43	39	40	40	44	26	25	27	22	31	26	21	24	20	22
Coccidiostat															
IV Narasin	0	1	1	6	12	0	0	0	0	0	0	2	7	17	12
Salinomycin	13	17	17	18	13	0	7	10	8	14	40	46	55	7	28
Total	**13**	**17**	**18**	**24**	**25**	**0**	**7**	**10**	**8**	**14**	**40**	**48**	**62**	**24**	**40**

Roman numerals IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to CIPARS 2018: Design and methods.

The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Farm Surveillance in turkeys

Summary of antimicrobials use by all routes of administration

Table 2. 14 Number of turkey flocks with reported antimicrobial use by route of administration, 2018

Antimicrobial use	Route of administration			
	Any route[a] n (%)	*In ovo*/subcutaneous n (%)	Feed n (%)	Water n (%)
Any antimicrobial use	34 (36)	8 (8)	34 (36)	19 (20)
No antimicrobial use[b]	61 (64)	87 (92)	61 (64)	76 (80)
Total flocks	**95 (100)**	**95 (100)**	**95 (100)**	**95 (100)**

[a] Flocks with reported use of an antimicrobial class by feed, water, *in ovo*/subcutaneous, or any combination of these routes are included in each count.

[b] These were flocks that were not medicated with any of the antimicrobials listed in Table 2. 15 (next page).

Table 2. 15 Frequency and quantity of antimicrobial use in turkeys, 2018

Route of administration	Antimicrobial	Flocks n (%)	Ration n (%)	Days exposed median (min. ; max.)[a]	Level of drug median (min. ; max.)[b]	Quantity of antimicrobial active ingredient[c]	
						mg/PCU	nDDDvetCA/ 1,000 turkey-days at risk
Feed					g/tonne		
II	Penicillin G procaine	3 (3)	4 (1)	25 (14 ; 28)	44 (33 ; 55)	1	2
	Virginiamycin	35 (37)	159 (34)	14 (5 ; 55)	22 (17 ; 44)	15	60
	Trimethoprim sulfadiazine	4 (4)	4 (1)	7 (4 ; 21)	300 (200 ; 300)	4	7
III	Bacitracin	26 (27)	113 (24)	14 (6 ; 33)	55 (55 ; 110)	30	35
	Chlortetracycline	2 (2)	2 (< 1)	8 (7 ; 8)	440 (440 ; 440)	1	1
IV	Bambermycin	4 (4)	15 (< 3)	14 (5 ; 28)	2 (2 ; 2)	0.1	
N/A	Avilamycin	3 (3)	7 (1)	10 (4 ; 35)	15 (15 ; 15)	1	2
No AMU in feed		34 (36)	163 (35)				
Total feed, medicated		**59 (64)**	**285 (68)**			**52**	**106**
Water			Treatment (n)		g/Liter		
I	Enrofloxacin	1 (1)	1	4 (4 ; 4)	0.03 (0.3 ; 0.3)	< 0.1	0.13
II	Amoxicillin	1 91)	1	4 (4 ; 4)	0.1 (0.1 ; 0.1)	< 0.1	< 0.1
	Penicillin	7 (7)	10	6 (4 ; 9)	0.2 (0.1 ; 0.2)	1	2
	Penicillin-streptomycin	2 (2)	2	3 (1 ; 4)	0.1 (0.02 ; 0.1)	0.1	0.1
III	Tetracycline	3 (3)	5	11 (7 ; 14)	0.9 (0.9 ; 0.9)	3.9	0.3
	Tetracycline-neomycin	1 (1)	2	4 (4 ; 5)	0.1 (0.1 ;0.2)	0.1	26
No AMU in water		76 (80)					
Total water, medicated		**19 (20)**	**21**			**5.0**	**27.8**
Injection					mg/egg or poult		
II	Gentamicin	8 (8)			1	0.02	0.02
No AMU via injection		87 (92)					
Total injection		**8 (8)**				**0.02**	**0.0**
All routes[d]		**59 (64)**				**57**	**134**

See corresponding footnotes on next page.

Table 2. 15 Frequency and quantity of antimicrobial use in turkeys, 2018 (continued)

Roman numerals I to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

AMU = antimicrobial use.

Combination antimicrobials include the values for both antimicrobial components. Grey shaded cells = no data or calculations/values are not applicable for turkeys.

mg/PCU = milligrams/population correction unit.

DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligrams per kilogram turkey per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

nDDDvetCA/1,000 turkey-days at risk = number of DDDvetCA/1,000 turkey-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

[a] Days exposed are by ration (not full grow-out) or 1 course of water treatment.

[b] Level of drug is in grams/tonne of feed or grams/liter drinking water. In water, "grams" is the inclusion rate multiplied by the concentration of the drug in that product. In poults or hatching eggs, level of drug is in milligrams per poult or hatching egg, as reported by the veterinarian/producer.

[c] Total quantity of antimicrobials were calculated based on feed or water consumed (feed and water were estimated based on breed standards).

[d] The final mg/PCU and nDDDvetCA/1,000 turkey-days at risk exclude coccidiostats. Flavophospholipids was included only in the mg/PCU.

Table 2. 16 Production, biomass and quantity of antimicrobials used, by province, 2014 to 2018

Province	Year	Number of flocks	Pre-harvest weight Mean (kg)	Age sampled Mean (days)	Active ingredient (mg)	Turkey weights[a] (kg)	mg/PCU		nDDDvetCA/1,000 turkey-days at risk	
							Total	%change[b]	Total	%change[b]
British Columbia	2014	29	9	87	120,484,974	1,759,872	68		115	
	2015	30	9	88	74,654,795	1,736,982	43	-37	136	18
	2016	30	9	88	96,093,296	1,973,663	49	13	88	-35
	2017	27	9	89	125,474,395	1,599,299	78	61	122	39
	2018	29	9	88	92,441,570	1,555,057	59	-24	186	53
Alberta	2018	11	9	86	31,830,633	526,087	61	N/A	113	N/A
Ontario	2016	30	10	91	102,916,844	1,170,514	88		143	
	2017	31	10	89	80,060,464	1,353,274	59	-33	111	-22
	2018	30	9	84	67,659,485	1,003,483	67	14	107	-4
Québec	2016	12	12	96	21,102,933	485,394	43		74	-31
	2017	16	11	90	20,387,058	626,239	33	-25	65	-12
	2018	25	11	90	33,539,890	873,834	38	18	81	25
National[c]	2016	72	10	90	220,091,068	3,629,571	61		104	
	2017	74	10	89	225,845,525	3,578,812	63	4	108	4
	2018	95	10	87	225,471,578	3,958,461	57	-10	134	24

Some values presented in this report slightly differ from the previous year's reports due to flock size corrections, improvement to the database and methodology refinements.

mg/PCU = milligrams/population correction unit.

DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligrams per kilogram turkey per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

nDDDvetCA/1,000 turkey-days at risk = number of DDDvetCA/1,000 turkey-days at risk.

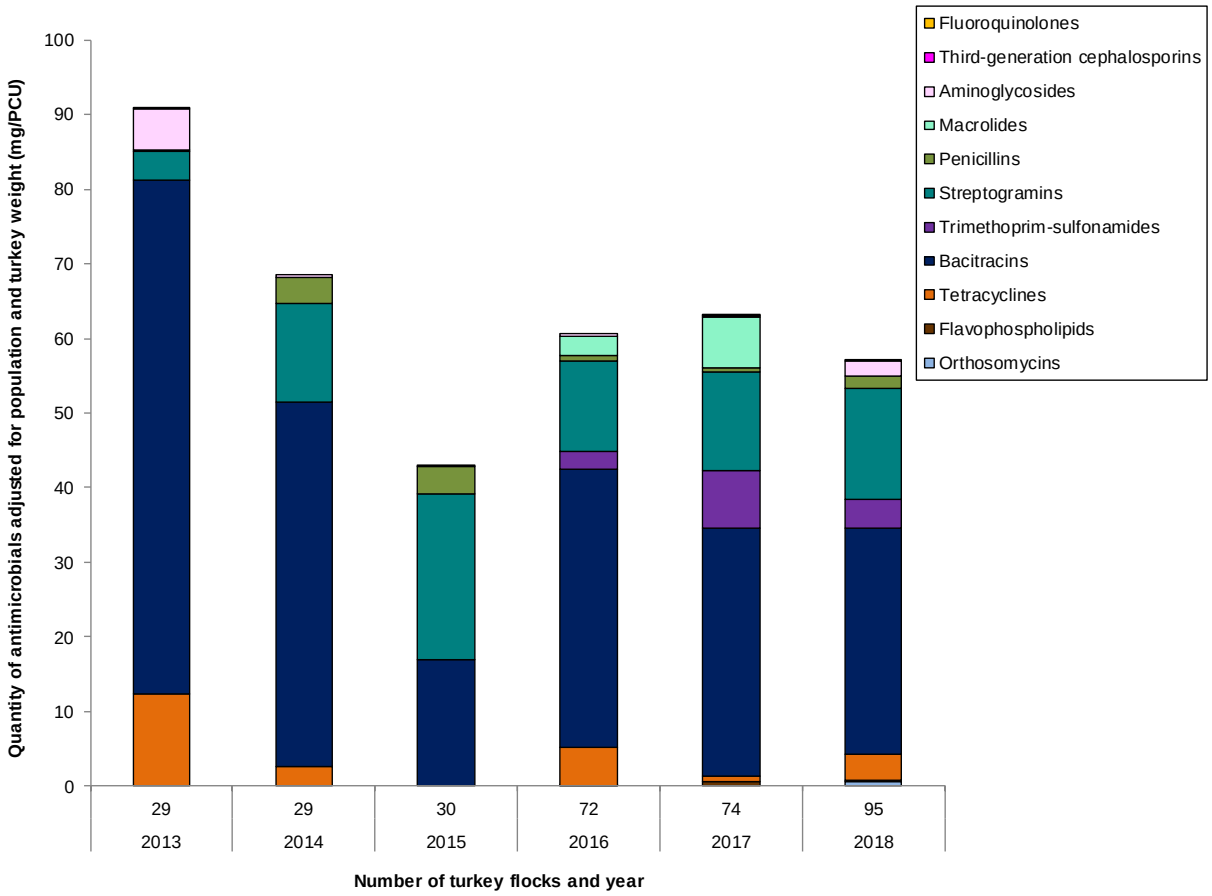
For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

[a] Population correction unit (PCU) or biomass, European weight (total flock population x ESVAC standard weight of 6.5 kg bird).

[b] Percent change = [(current surveillance year – previous surveillance year)/previous surveillance year] x 100.

[c] Includes only the provinces/regions surveyed and combines the quantity of antimicrobials used in feed, water and injection excluding coccidiostats, antiprotozoals, arsenicals and flavophospholipids.

Figure 2. 47 Quantity of antimicrobial use in all routes of administration, adjusted for population and turkey weight (mg/PCU), 2013 to 2018



Year Number of flocks		2013 29	2014 29	2015 30	2016 72	2017 74	2018 95
Antimicrobial class							
I	Fluoroquinolones	0	0	0	0	< 0.1	< 0.1
	Third-generation cephalosporins	< 0.1	0	0	0	0	0
II	Aminoglycosides	5	0.3	0.1	0.4	0.2	2
	Macrolides	0	0	0	3	7	0
	Penicillins	0.2	3	4	1	1	2
	Streptogramins	4	13	22	12	13	15
	Trimethoprim and sulfonamides	0	0	0	2	8	4
III	Bacitracins	69	49	17	37	33	30
	Tetracyclines	12	3	0	5	1	3
IV	Flavophospholipids	0	0	0	0.1	0.7	0.1
N/A	Orthosomycins	0	0	0	0	0	1
Total		**91**	**68**	**43**	**61**	**63**	**57**

Roman numerals I to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

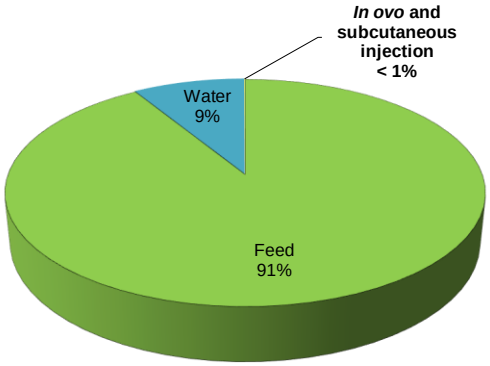
N/A = not applicable (no classification available at the time of writing of this report).

mg/PCU = milligrams/population correction unit.

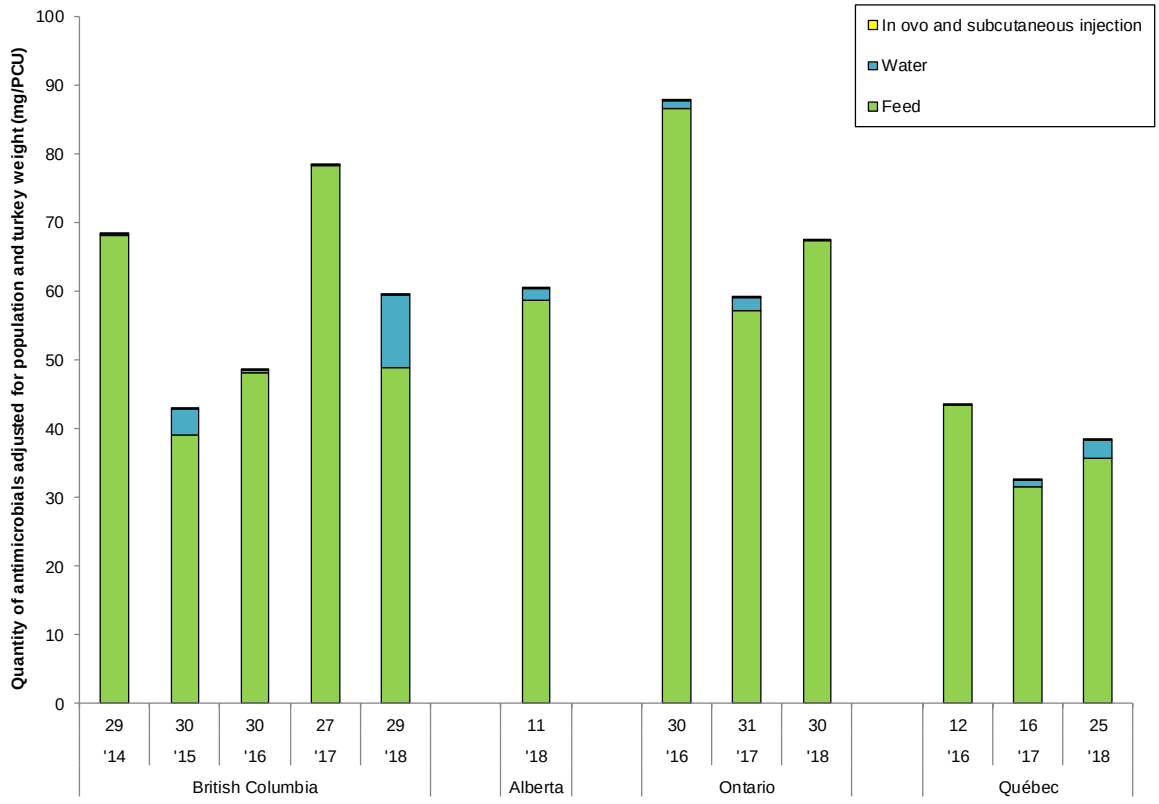
2013 to 2015 data pertains to British Columbia.

Figure 2. 48 Quantity of antimicrobials, adjusted for population and turkey weight (mg/PCU), in 2018 and by province, 2014 to 2018

a) 2018



b) by province



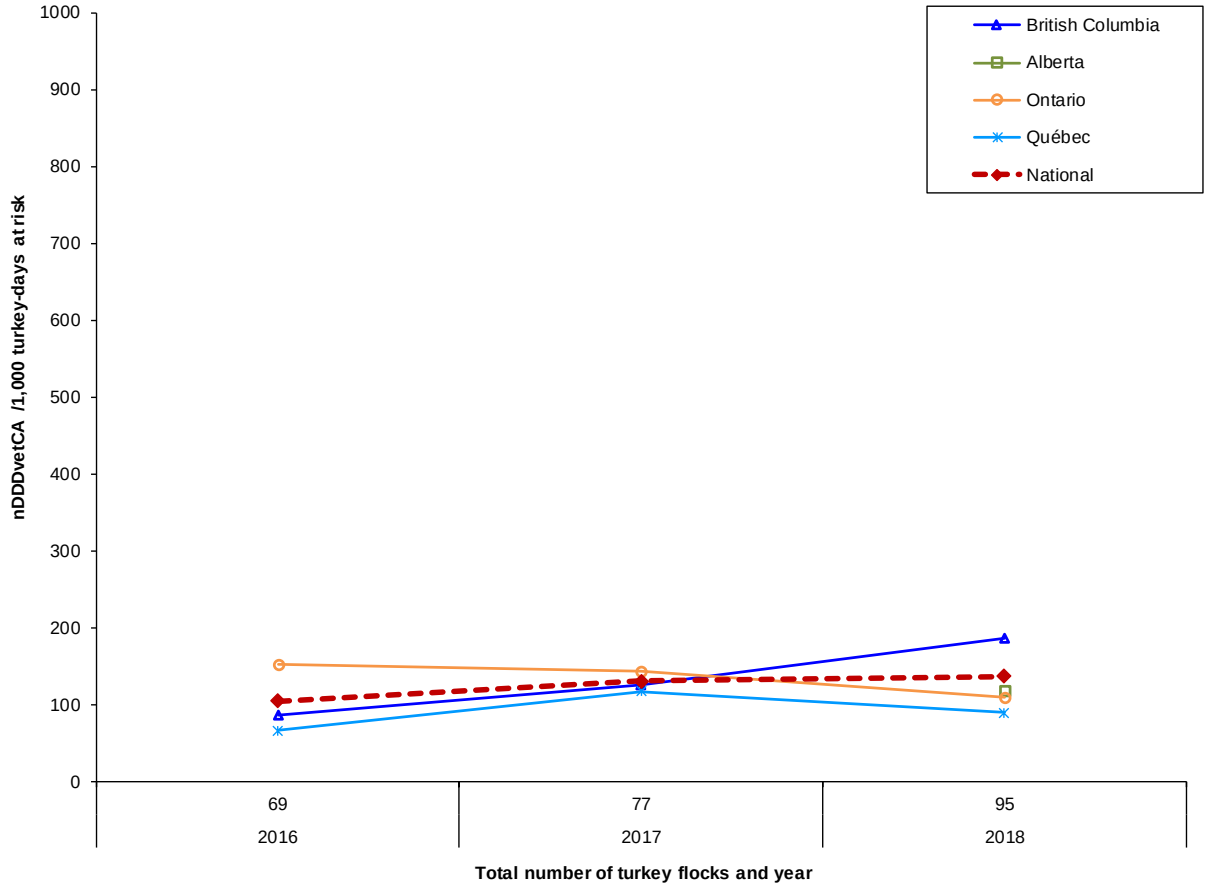
Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Route of administration												
Feed	68	39	48	78	49	59	87	57	67	43	32	36
Water	0.2	4	0.4	0	11	2	1	2	0	0	1	3
In ovo and subcutaneous injection	0.1	0.1	0.13	0.1	< 0.1	< 0.1	0.13	0.1	< 0.1	0.1	0.1	< 0.1
Total	**68**	**43**	**49**	**78**	**59**	**61**	**88**	**59**	**67**	**43**	**33**	**38**

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Data in figure pertains to the current year (pie) and data in table includes 1 to 5 years.

Figure 2. 49 Number of Canadian Defined Daily Doses for animals per 1,000 turkey-days at risk (nDDDvetCA/1,000 turkey-days at risk) for all routes of administration by province, 2016 to 2018



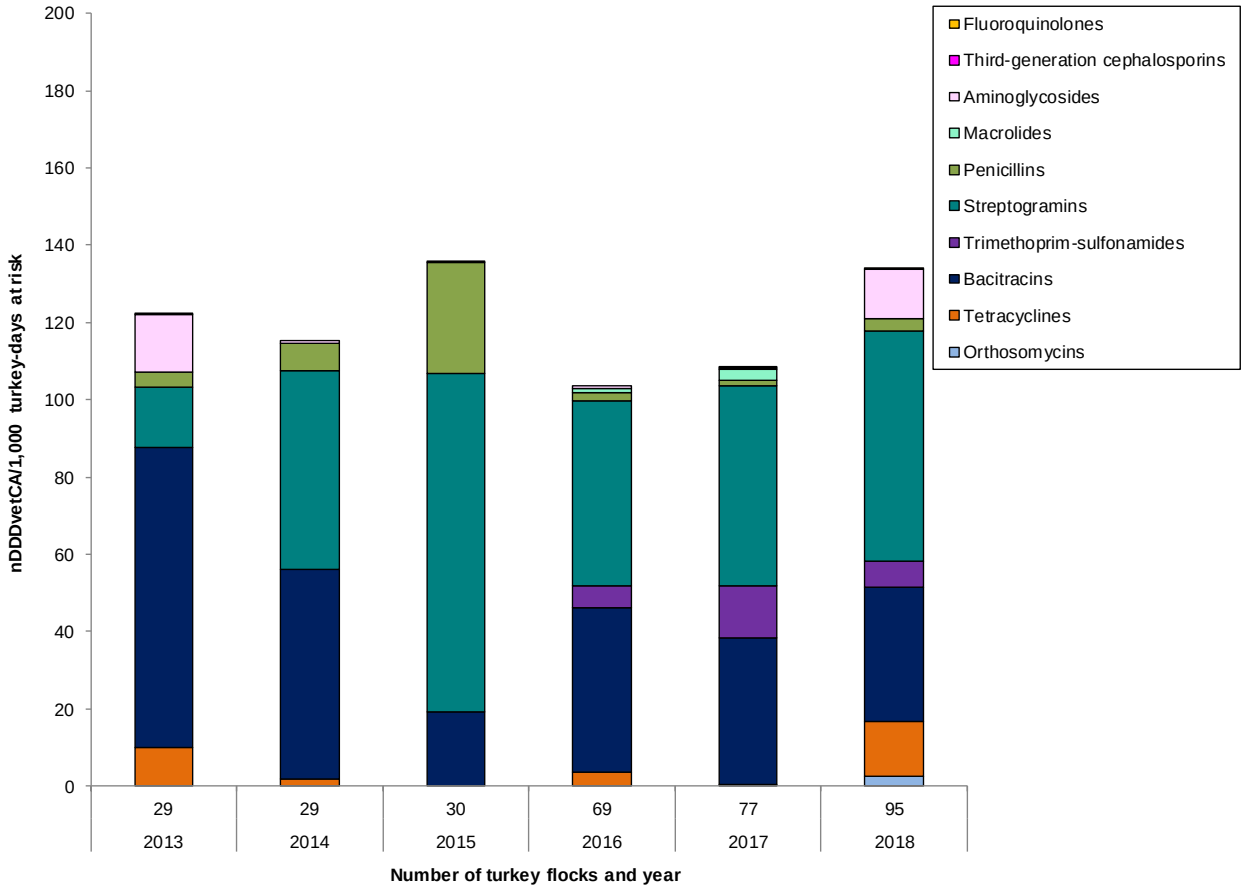
Year Number of flocks	2016 217	2017 82	2018 95
Province			
British Columbia	86	125	186
Alberta			119
Ontario	152	143	110
Québec	66	117	89
National	**104**	**131**	**137**

DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

nDDDvetCA/1,000 broiler chicken-days at risk = Number of DDDvetCA/1,000 broiler chicken-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Figure 2. 50 Number of Canadian Defined Daily Doses for animals per 1,000 turkey-days at risk (nDDDvetCA/1,000 turkey-days at risk) for all routes of administration, 2013 to 2018



Year Number of flocks		2013 29	2014 29	2015 30	2016 69	2017 77	2018 95
Antimicrobial class							
I	Fluoroquinolones	0	0	0	0	< 0.1	0.1
	Third-generation cephalosporins	< 0.1	0	0	0	0	0
II	Aminoglycosides	14.7	1	0.1	1	0.3	13
	Macrolides	0	0	0	1	3	0
	Penicillins	4	7	29	2	1	3
	Streptogramins	16	51	87	48	52	60
	Trimethoprim and sulfonamides	0	0	0	5	13	7
III	Bacitracins	78	54	19	43	38	35
	Tetracyclines	10	2	0	4	0.4	14
N/A	Orthosomycins	0	0	0	0	0	2
Total		**122**	**115**	**136**	**104**	**108**	**134**

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).

DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

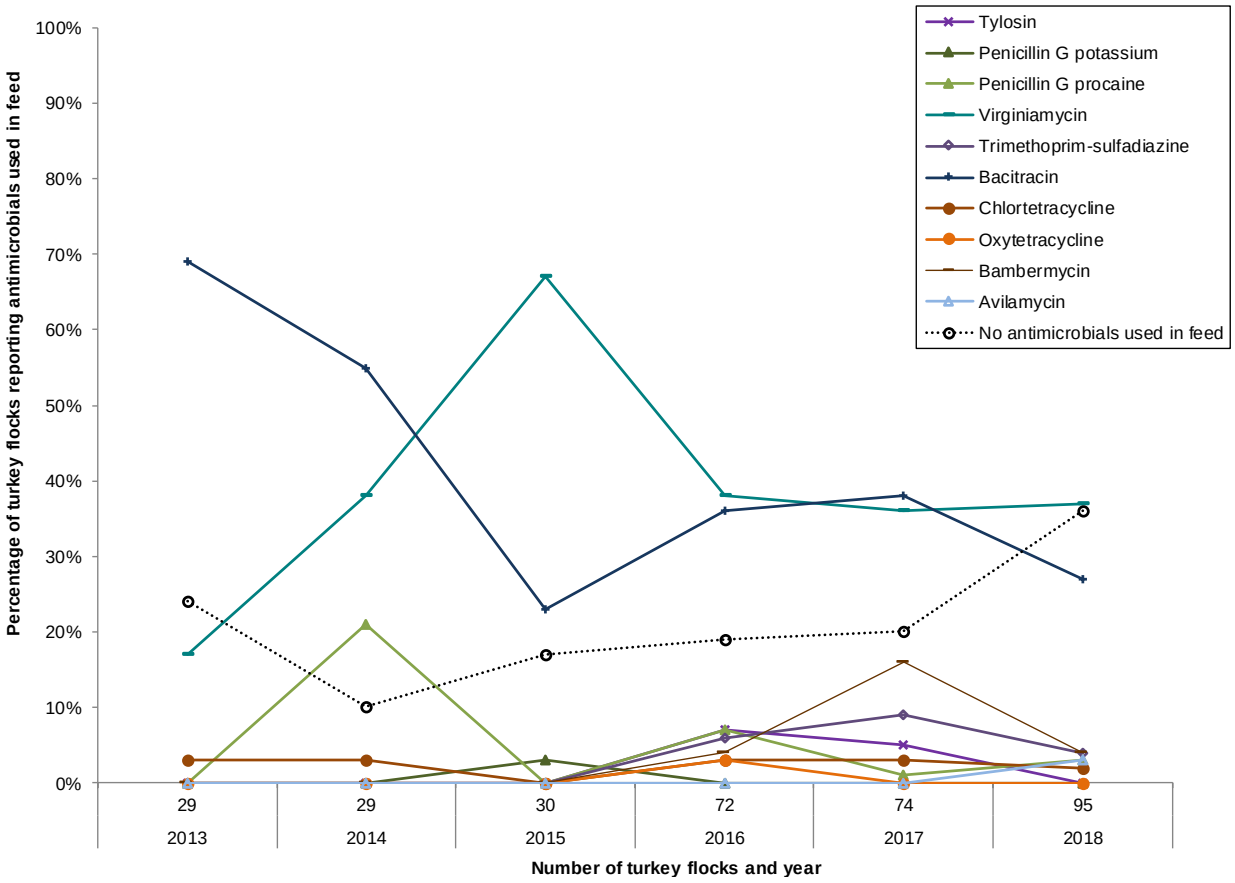
nDDDvetCA/1,000 broiler chicken-days at risk = Number of DDDvetCA/1,000 broiler chicken-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

2013 to 2015 data pertains to British Columbia.

Antimicrobial use in feed by frequency

Figure 2. 51 Percentage of turkey flocks reporting antimicrobial use in feed, 2013 to 2018



Year Number of flocks		2013 29	2014 29	2015 30	2016 72	2017 74	2018 95
Antimicrobial							
II	Tylosin	0%	0%	0%	**7%**	**5%**	**0%**
	Penicillin G potassium	0%	0%	3%	**0%**	**0%**	**0%**
	Penicillin G procaine	0%	21%	0%	**7%**	**1%**	**3%**
	Virginiamycin	17%	38%	67%	**38%**	**36%**	**37%**
	Trimethoprim-sulfadiazine	0%	0%	0%	**6%**	**9%**	**4%**
III	Bacitracin	69%	55%	23%	**36%**	**38%**	**27%**
	Chlortetracycline	3%	3%	0%	**3%**	**3%**	**2%**
	Oxytetracycline	0%	0%	0%	**3%**	**0%**	**0%**
IV	Bambermycin	0%	0%	0%	**4%**	**16%**	**4%**
N/A	Avilamycin	0%	0%	0%	**0%**	**0%**	**3%**
	No antimicrobials used in feed	24%	10%	17%	**19%**	**20%**	**36%**

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).

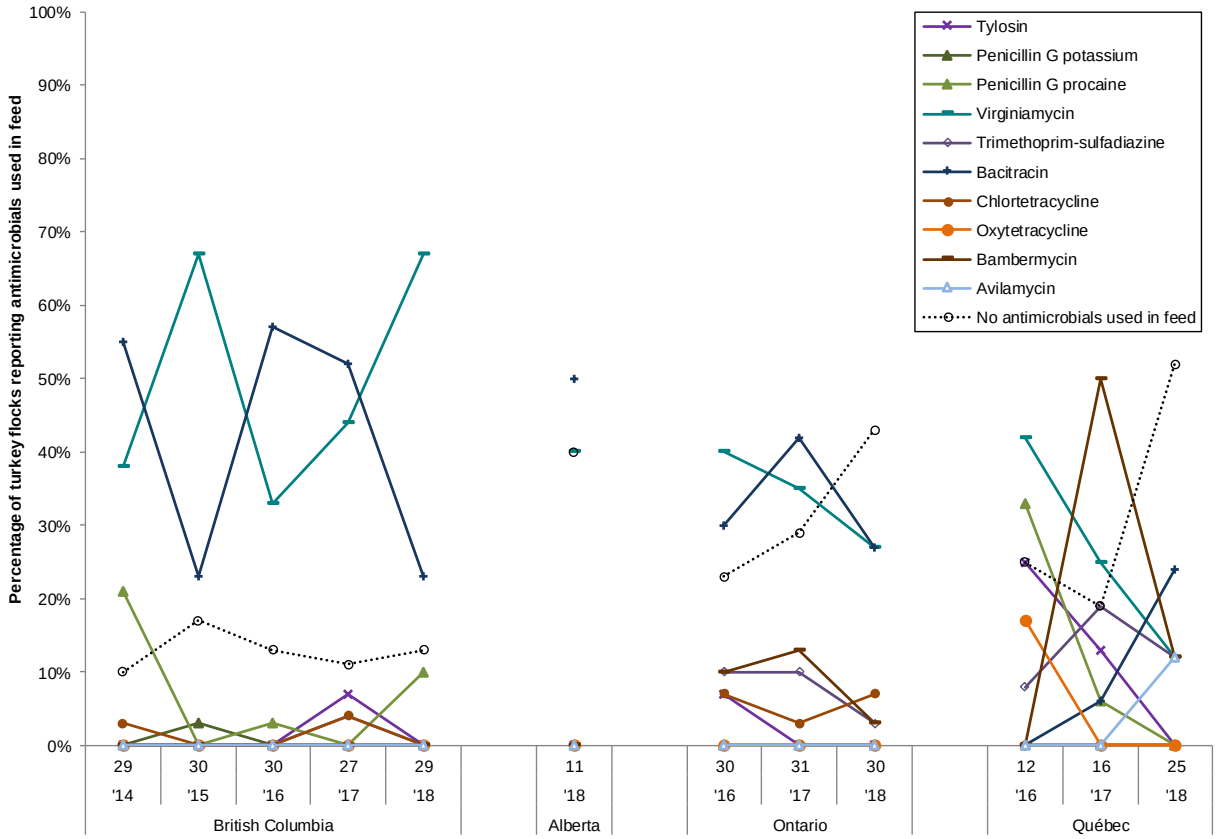
Numbers per column may not add up to 100% as some flocks may have used an antimicrobial more than once or used multiple antimicrobials throughout the grow-out period.

For the temporal analyses, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in 2016 (program started at the national level) and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.

Please note that the "no antimicrobials used" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories II to IV and avilamycin).

2013 to 2015 data pertains to British Columbia.

Figure 2. 52 Percentage of turkey flocks reporting antimicrobial use in feed by province, 2014 to 2018



Number of turkey flocks, year and province

Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Antimicrobial												
Tylosin	0%	0%	0%	7%	0%	0%	7%	0%	0%	25%	13%	0%
Penicillin G potassium	0%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
II Penicillin G procaine	21%	0%	3%	0%	10%	0%	0%	0%	0%	33%	6%	0%
Virginiamycin	38%	67%	33%	44%	67%	40%	40%	35%	27%	42%	25%	12%
Trimethoprim-sulfadiazine	0%	0%	0%	4%	0%	0%	10%	10%	3%	8%	19%	12%
Bacitracin	55%	23%	57%	52%	23%	50%	30%	42%	27%	0%	6%	24%
III Chlortetracycline	3%	0%	0%	4%	0%	0%	7%	3%	7%	0%	0%	0%
Oxytetracycline	0%	0%	0%	0%	0%	0%	0%	0%	0%	17%	0%	0%
IV Bambermycin	0%	0%	0%	0%	0%	0%	10%	13%	3%	0%	50%	12%
N/A Avilamycin	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	12%
No antimicrobials used in feed	10%	17%	13%	11%	13%	40%	23%	29%	43%	25%	19%	52%

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).

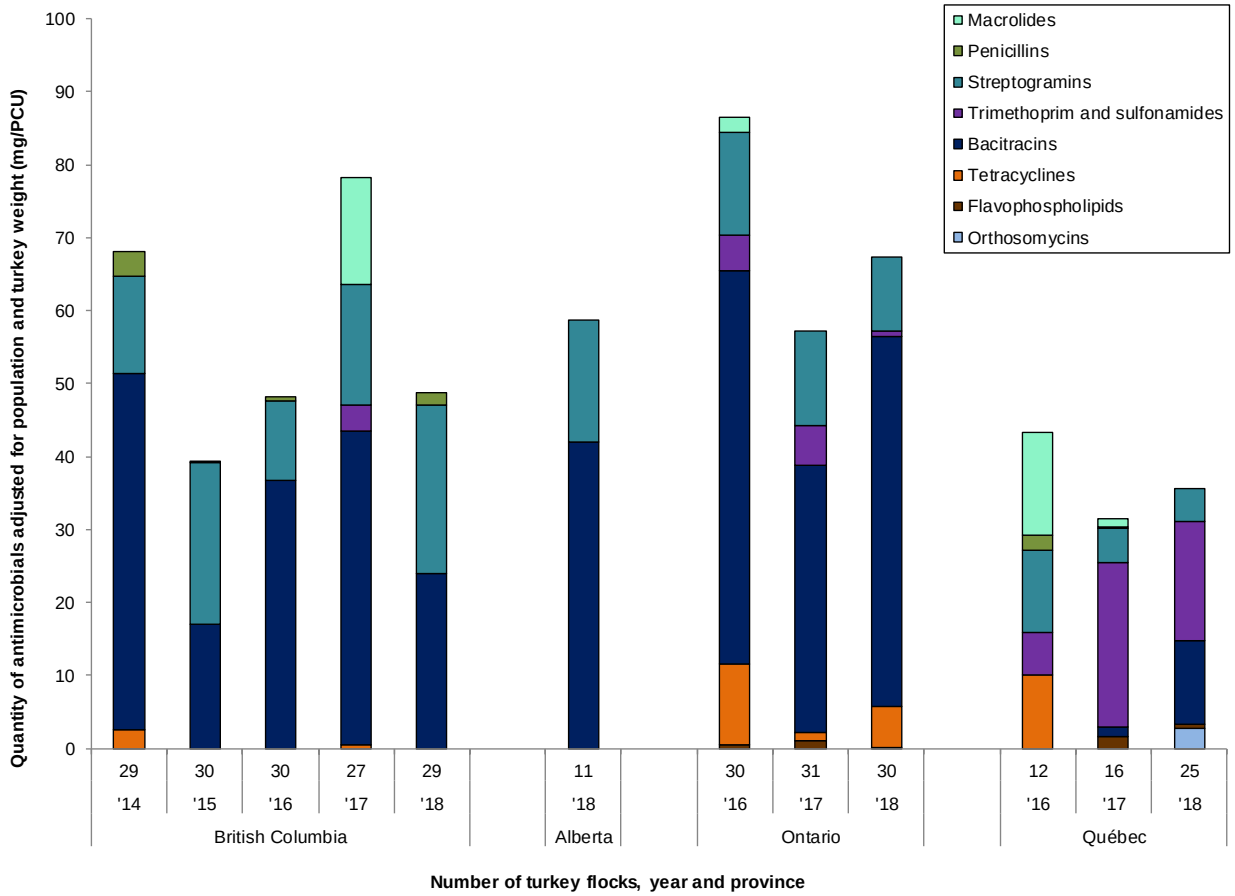
Numbers per column may not add up to 100% as some flocks may have used an antimicrobial more than once or used multiple antimicrobials throughout the grow-out period.

For the temporal analyses within province, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in 2016 (program started at the national level) and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) within province for a given antimicrobial. The presence of red areas indicates significant provincial differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial differences ($P \leq 0.05$) for a given antimicrobial.

Please note that the "no antimicrobials used" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories II to IV and avilamycin).

Antimicrobial use in feed by quantitative indicators

Figure 2. 53 Quantity of antimicrobial use in feed adjusted for population and turkey weight (mg/PCU), 2014 to 2018



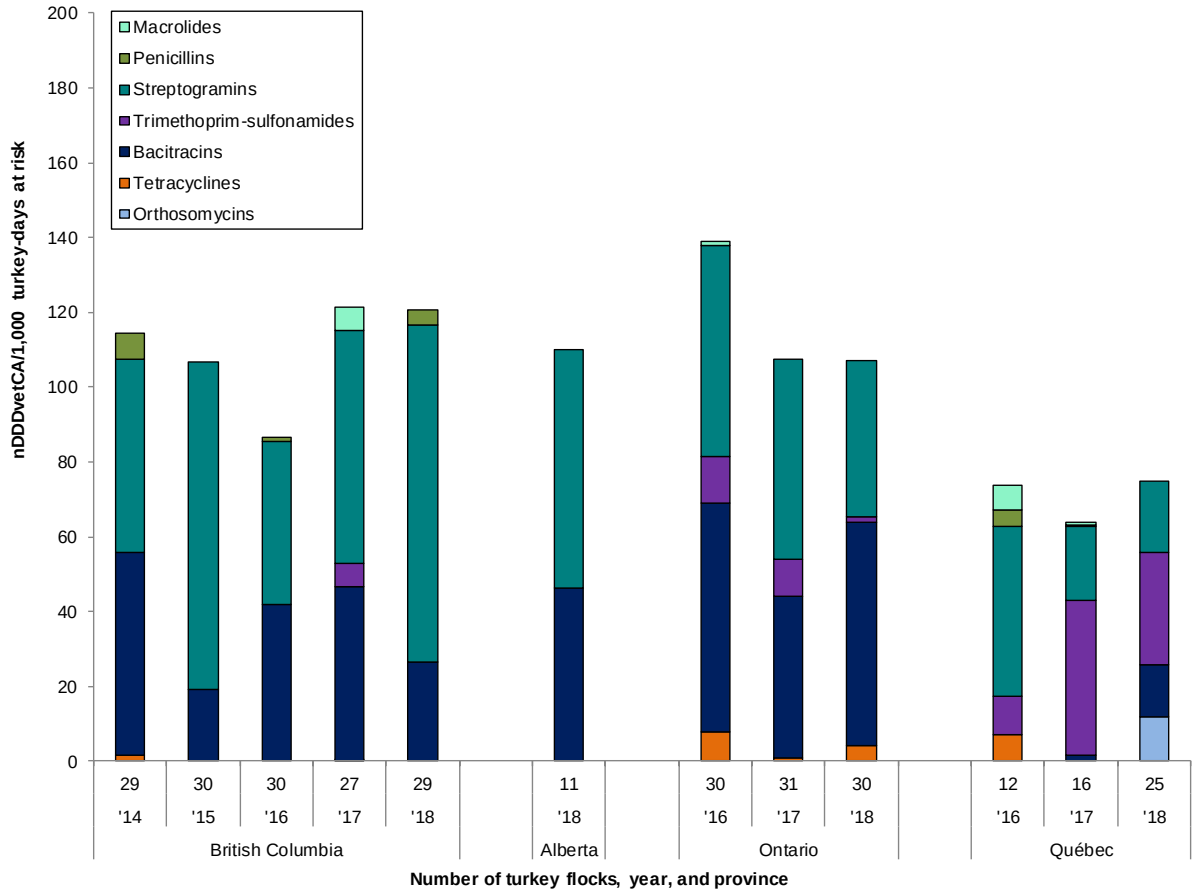
Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Antimicrobial class												
II Macrolides	0	0	0	15	0	0	2.1	0	0	14	1	0
II Penicillins	3	< 0.1	0.4	0	2	0	0	0	0	2	0.1	0
II Streptogramins	13	22	11	17	26	17	14	13	10	11	5	5
II Trimethoprim and sulfonamides	0	0	0	4	0	0	5	5	1	6	22	16
III Bacitracins	49	17	37	43	26	42	54	37	51	0	1	12
III Tetracyclines	3	0	0	0.4	0	0	11	1	6	10	0	0
IV Flavophospholipids	0	0	0	0	0	0	0	0	0.0	0	0	0.4
N/A Orthosomycins	0	0	0	0	0	0	0	0	0	0	0	3
Total	**68**	**39**	**48**	**78**	**54**	**59**	**86**	**56**	**67**	**43**	**30**	**36**

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Figure 2. 54 Number of Canadian Defined Daily Doses for animals per 1,000 turkey-days at risk (nDDDvetCA/1,000 turkey-days at risk for antimicrobials administered in feed, 2014 to 2018



Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Antimicrobial class												
II Macrolides	0	0	0	6	0	0	0.9	0	0	6	1	0
II Penicillins	7	< 0.1	0.9	0	4	0	0	0	0	5	0.3	0
II Streptogramins	51	87	44	62	97	64	56	53	42	45	20	19
II Trimethoprim and sulfonamides	0	0	0	6	0	0	13	10	2	10	41	30
III Bacitracins	54	19	42	47	29	46	61	43	60	0	2	14
III Tetracyclines	2	0	0	0.3	0	0	8	1	4	7	0	0
N/A Orthosomycins	0	0	0	0	0	0	0	0	0	0	0	12
Total	**115**	**107**	**86**	**121**	**130**	**110**	**139**	**107**	**107**	**74**	**64**	**75**

Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).

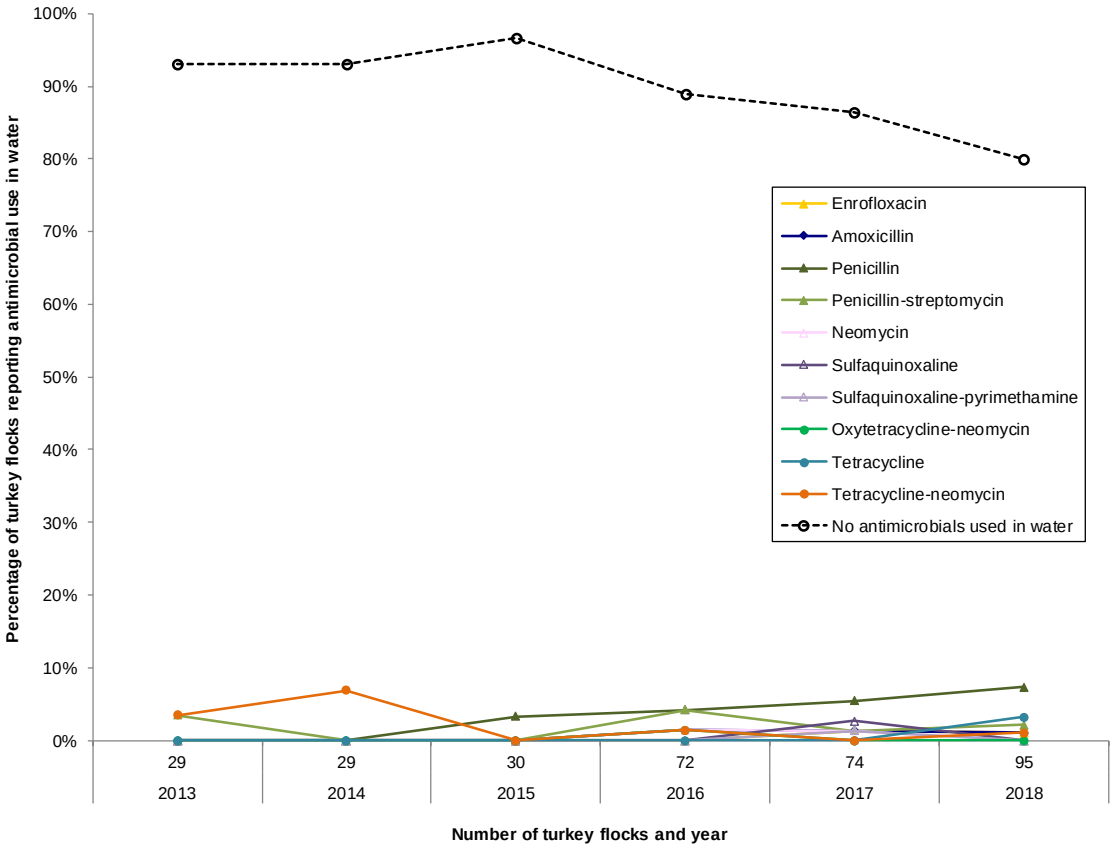
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram turkey weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

nDDDvetCA/1,000 turkey-days at risk = number of DDDvetCA/1,000 turkey-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Antimicrobial use in water by frequency

Figure 2. 55 Percentage of turkey flocks reporting antimicrobial use in water, 2013 to 2018



Year	2013	2014	2015	2016	2017	2018
Number of flocks	29	29	30	72	74	95
Antimicrobial						
I Enrofloxacin	0%	0%	0%	**0%**	**1%**	**1%**
II Amoxicillin	0%	0%	0%	**1%**	**1%**	**1%**
II Penicillin	0%	0%	3%	**4%**	**5%**	**7%**
II Penicillin-streptomycin	3%	0%	0%	**4%**	**1%**	**2%**
II Neomycin	0%	0%	0%	**1%**	**1%**	**0%**
III Sulfaquinoxaline	0%	0%	0%	**0%**	**3%**	**0%**
III Sulfaquinoxaline-pyrimethamine	0%	0%	0%	**0%**	**1%**	**0%**
III Oxytetracycline-neomycin	0%	0%	0%	**1%**	**0%**	**0%**
III Tetracycline	0%	0%	0%	**0%**	**0%**	**3%**
III Tetracycline-neomycin	3%	7%	0%	**1%**	**0%**	**1%**
No antimicrobials used in water	93%	93%	97%	**89%**	**86%**	**80%**

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

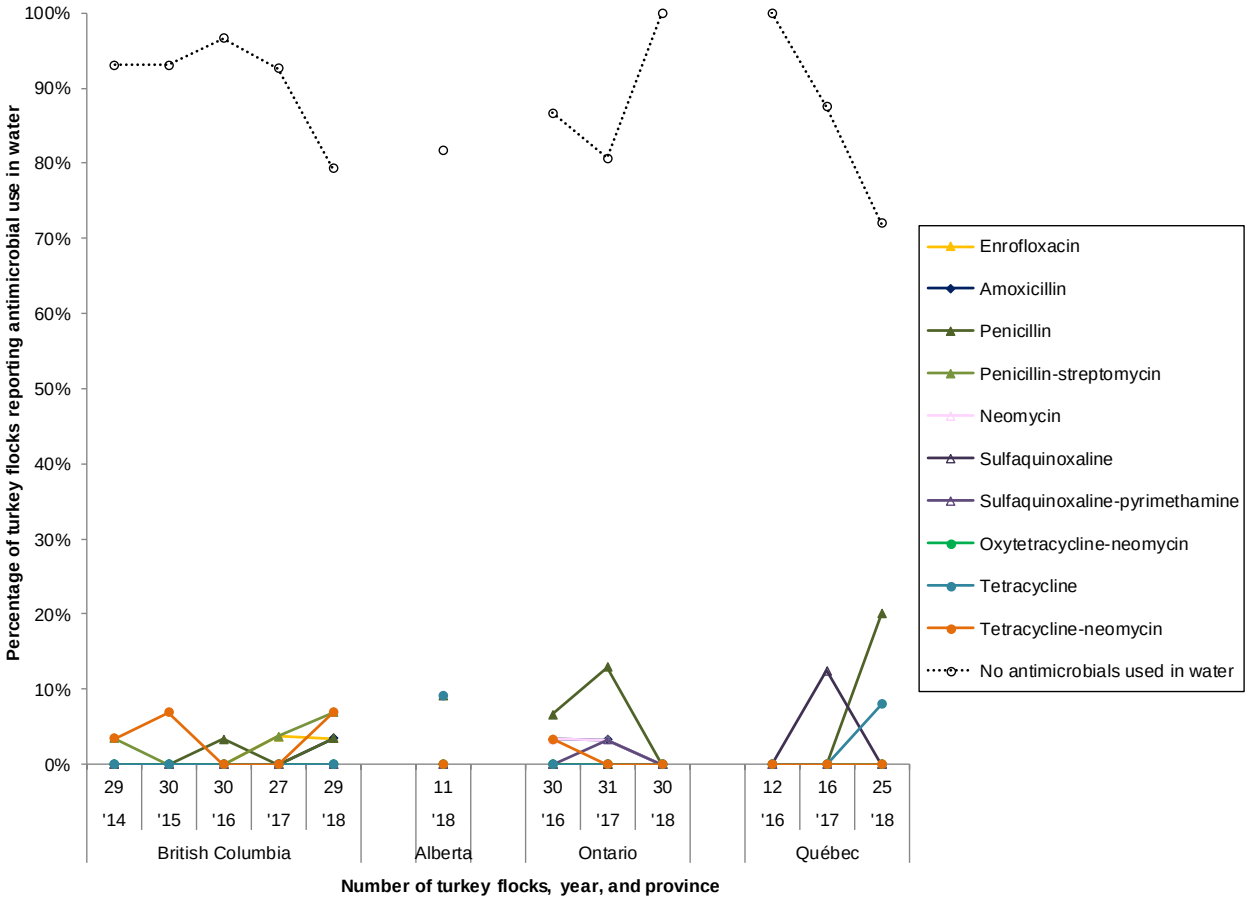
Numbers per column may not add up to 100% as some flocks have used an antimicrobial more than once or used multiple antimicrobials throughout the growing period.

For the temporal analysis, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in 2016 (program started at the national level) and previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.

Please note that the "no antimicrobials used" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories I to III).

2013 to 2015 data pertains to British Columbia.

Figure 2. 56 Percentage of turkey flocks reporting antimicrobial use in water by province, 2014 to 2018



Province		British Columbia					Alberta	Ontario			Québec		
Year		'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks		29	30	30	27	29	11	30	31	30	12	16	25
Antimicrobial													
I	Enrofloxacin	0%	0%	0%	4%	3%	0%	0%	0%	0%	0%	0%	0%
II	Amoxicillin	0%	0%	0%	0%	3%	0%	3%	3%	0%	0%	0%	0%
II	Penicillin	0%	0%	3%	0%	3%	9%	7%	13%	0%	0%	0%	20%
II	Penicillin-streptomycin	3%	0%	0%	4%	7%	0%	0%	0%	0%	0%	0%	0%
III	Neomycin	0%	0%	0%	0%	0%	0%	3%	3%	0%	0%	0%	0%
III	Sulfaquinoxaline	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	13%	0%
III	Sulfaquinoxaline-pyrimethamine	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%	0%
III	Oxytetracycline-neomycin	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
III	Tetracycline	0%	0%	0%	0%	0%	9%	0%	0%	0%	0%	0%	8%
III	Tetracycline-neomycin	3%	7%	0%	0%	7%	0%	3%	0%	0%	0%	0%	0%
	No antimicrobials used in water	93%	93%	97%	93%	79%	82%	87%	81%	100%	100%	88%	72%

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

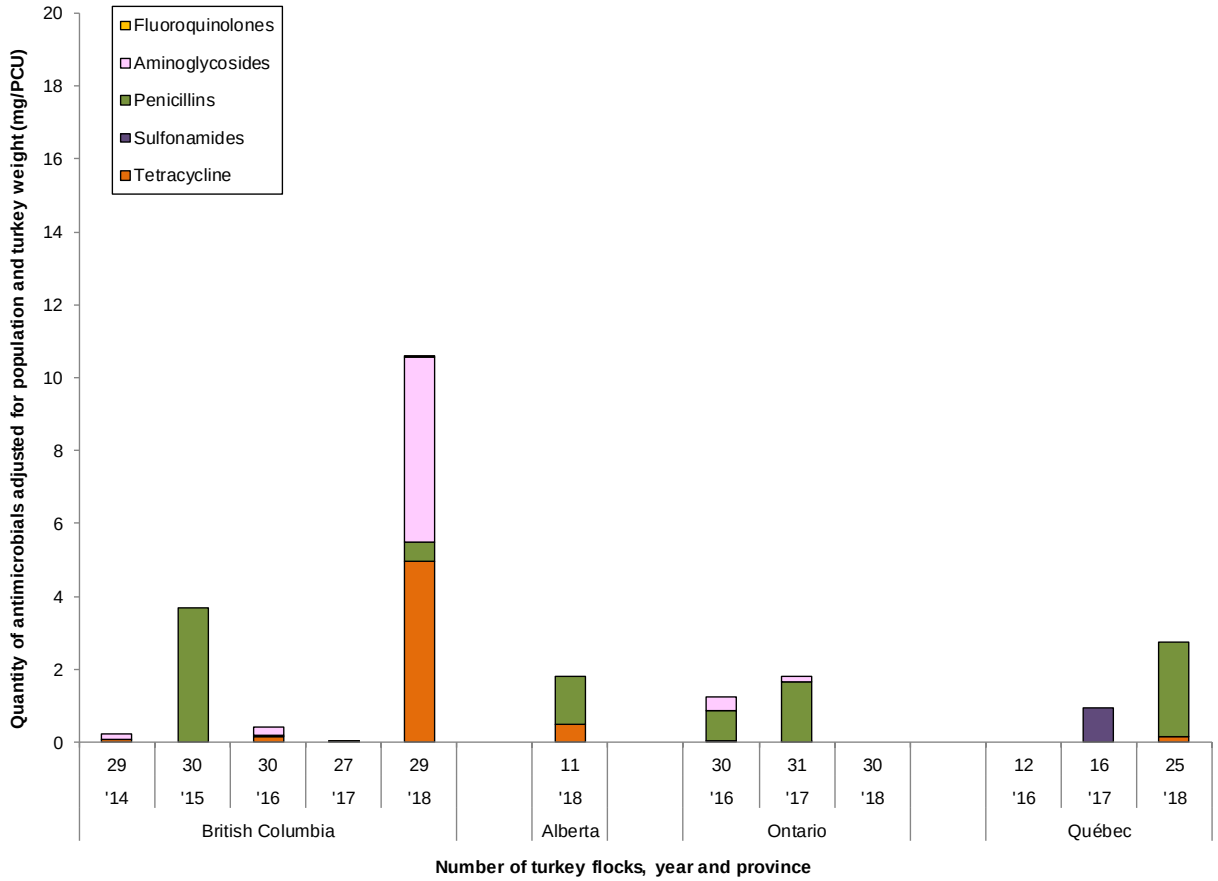
Numbers per column may not add up to 100% as some flocks have used an antimicrobial more than once or used multiple antimicrobials throughout the growing period.

For the temporal analysis within province, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in 2016 (program started at the national level) and previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) within province for a given antimicrobial. The presence of red areas indicates significant provincial differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial differences ($P \leq 0.05$) for a given antimicrobial.

Please note that the "no antimicrobials used" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories I to III).

Antimicrobial use in water by quantitative indicators

Figure 2. 57 Quantity of antimicrobial use in water adjusted for population and turkey weight (mg/PCU), 2014 to 2018



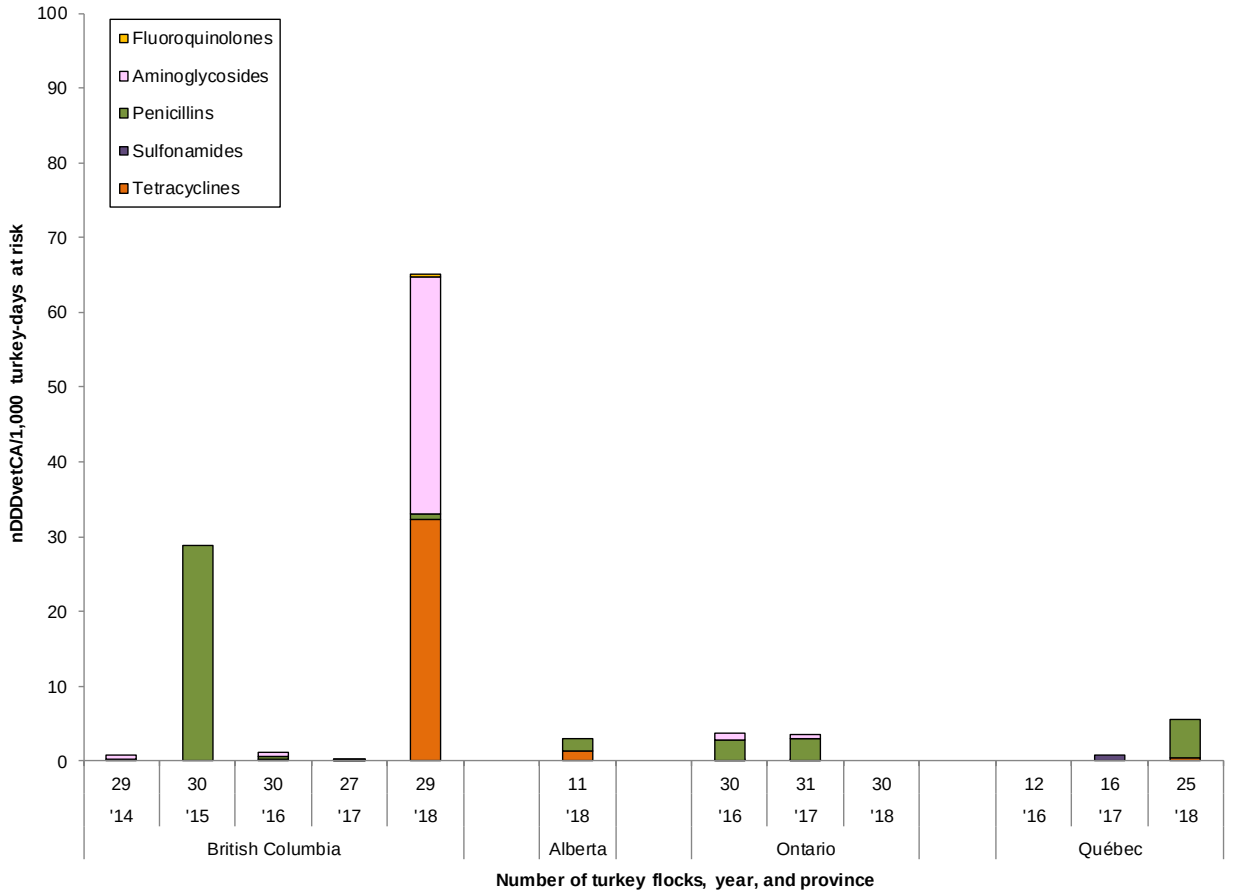
Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Antimicrobial class												
I Fluoroquinolones	0	0	0	< 0.1	< 0.1	0	0	0	0	0	0	0
II Aminoglycosides	0.2	0	0.2	< 0.1	5.1	0	0.3	0.2	0	0	0	0
II Penicillins	0	3.7	< 0.1	< 0.1	0.5	1	1	1.6	0	0	0	2.6
III Sulfonamides	0	0	0	0	0	0	0	0	0	0	1	0
III Tetracyclines	0.1	0	0.2	0	5	0.5	< 0.1	0	0	0	0	0.2
Total	**0.2**	**3.7**	**0.4**	**< 0.1**	**10.6**	**1.8**	**1.2**	**1.8**	**0**	**0**	**0.9**	**2.7**

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

mg/PCU = milligrams/population correction unit

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Figure 2. 58 Number of Canadian Defined Daily Doses for animals per 1,000 turkey-days at risk (nDDDvetCA/1,000 turkey-days at risk) for antimicrobials administered in water, 2014 to 2018



Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Antimicrobial class												
I Fluoroquinolones	0	0	0	< 0.1	0.3	0	0	0	0	0	0	0
II Aminoglycosides	0.5	0.0	0.5	< 0.1	31.8	0	0.9	0.4	0	0	0	0
II Penicillins	0	28.8	0.3	< 0.1	0.6	2	3	2.9	0	0	0	5.2
III Sulfonamides	0	0	0	0	0	0	0	0.1	0	0	1	0
III Tetracyclines	0	0	0.3	0	32	1	0.1	0	0	0	0	0
Total	**0.7**	**28.8**	**1.1**	**< 0.1**	**65.0**	**3.0**	**3.6**	**3.5**	**0**	**0**	**0.7**	**5.6**

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

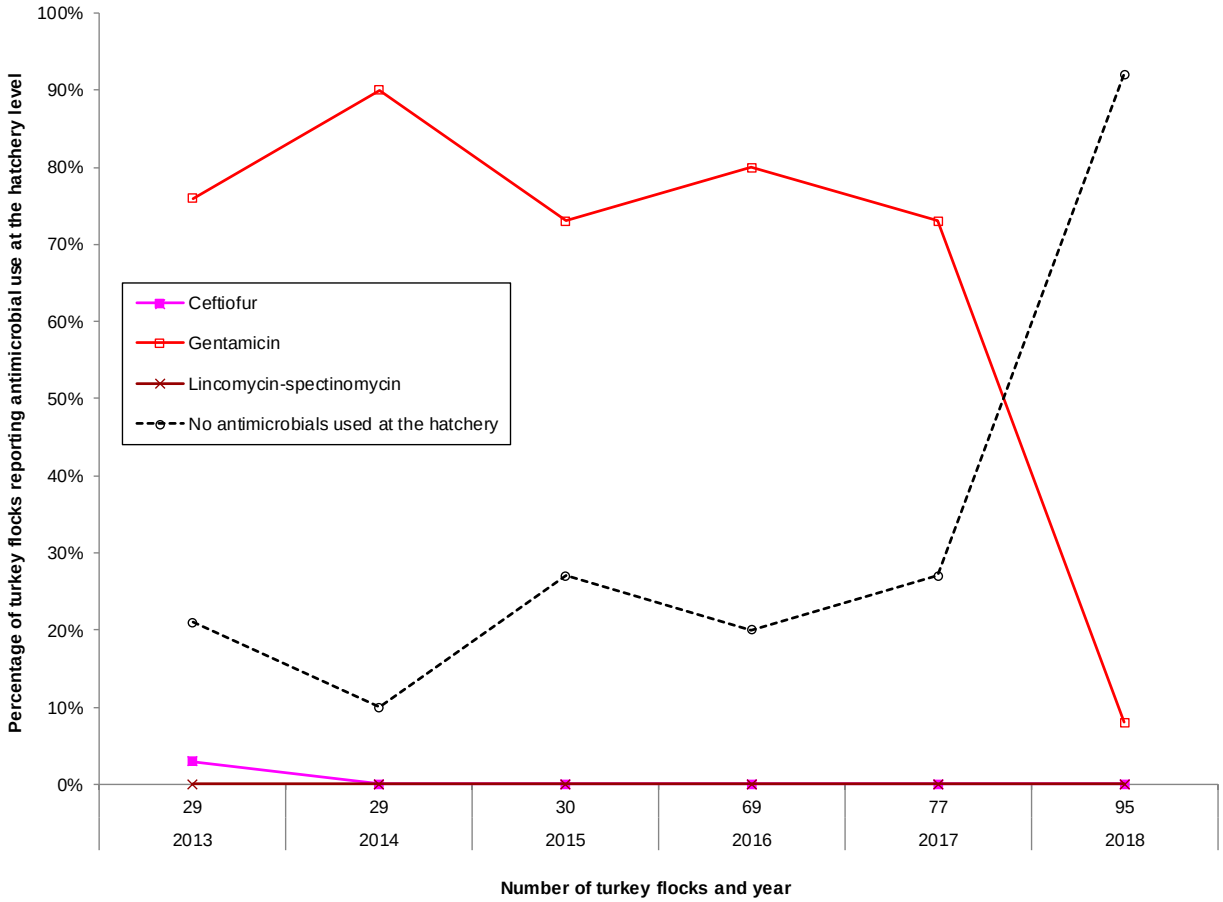
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram turkey weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

nDDDvetCA/1,000 turkey-days at risk = number of DDDvetCA/1,000 turkey-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Antimicrobials use *in ovo* or subcutaneous injection by frequency

Figure 2. 59 Percentage of turkey flocks reporting antimicrobial use *in ovo* or subcutaneous injection, 2013 to 2018

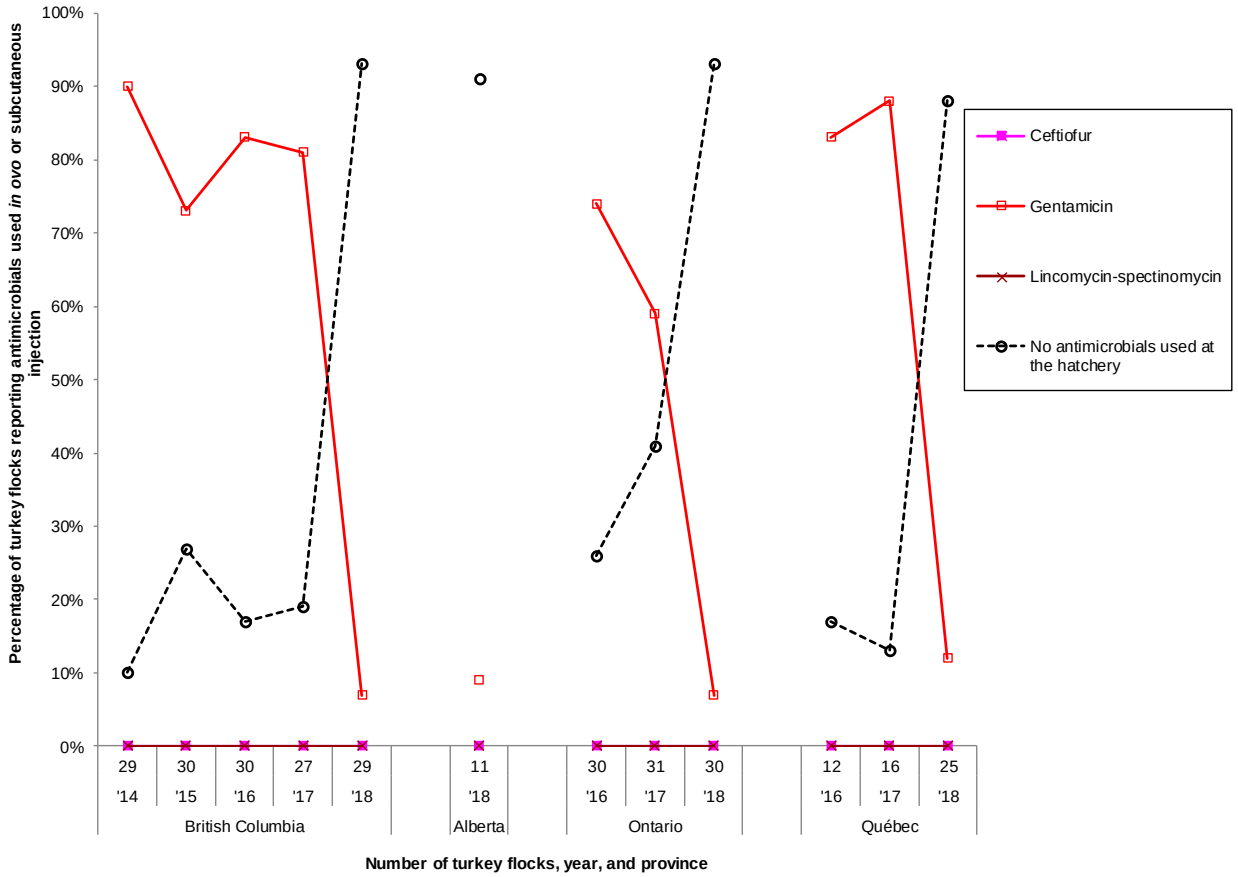


Year Number of flocks		2013 29	2014 29	2015 30	2016 69	2017 77	2018 95
Antimicrobial							
I	Ceftiofur	3%	0%	0%	**0%**	**0%**	**0%**
II	Gentamicin	76%	90%	73%	**80%**	**73%**	**8%**
	Lincomycin-spectinomycin	0%	0%	0%	**0%**	**0%**	**0%**
	No antimicrobials used at the hatchery	21%	10%	27%	**20%**	**27%**	**92%**

Roman numerals I and II indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Numbers per column may not add up to 100% due to rounding or batches of chicks (hatched at the same time to supply 1 barn) may have used more than one antimicrobial.
Data represent flocks medicated at the hatchery at day 18 of incubation or upon hatch.
For the temporal analyses, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in 2016 (national program started) and previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.
Please note that the "no antimicrobials used" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories I and II).

2013 to 2015 data pertains to British Columbia.

Figure 2. 60 Percentage of turkey flocks reporting antimicrobial use *in ovo* or subcutaneous injection by province, 2014 to 2018

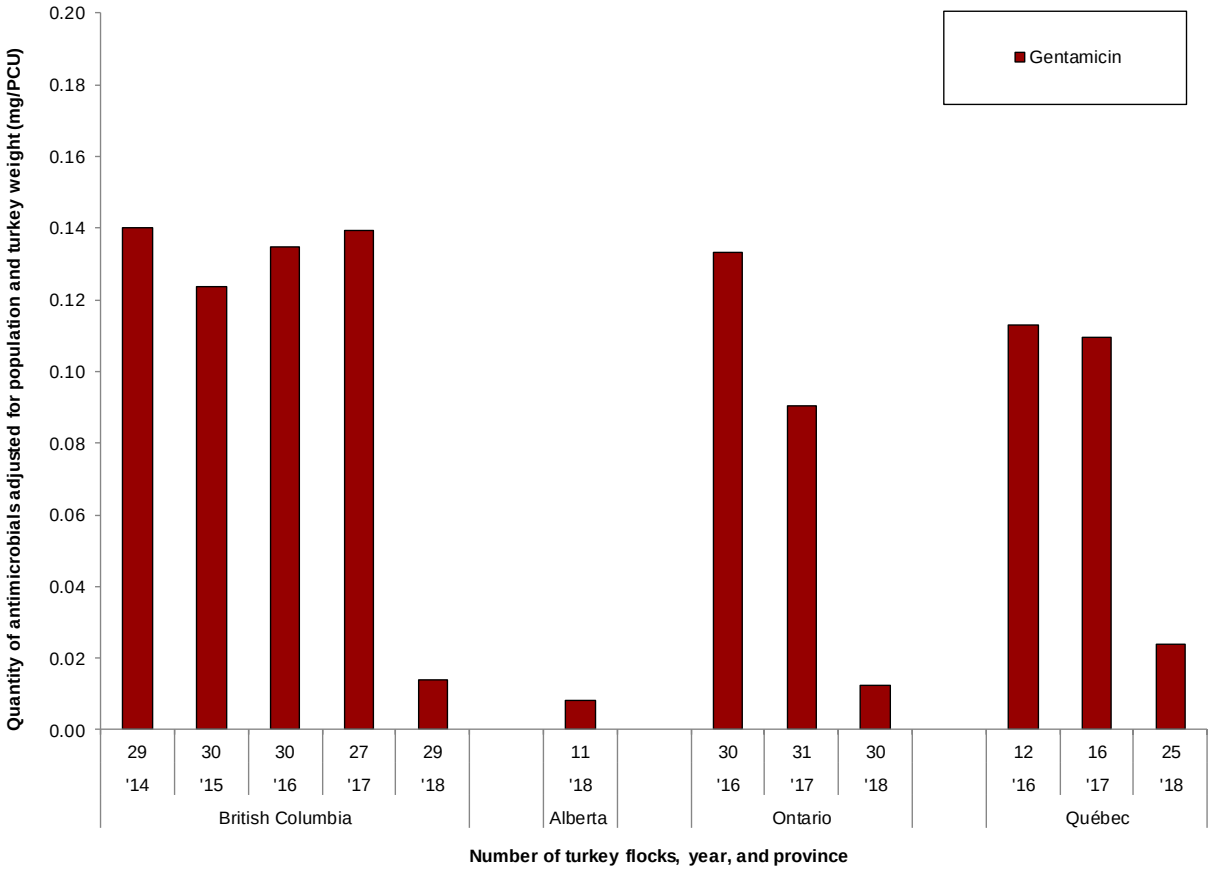


Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Antimicrobial												
I Ceftiofur	0%	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
II Gentamicin	90%	73%	**83%**	**81%**	**7%**	9%	**74%**	**59%**	**7%**	**83%**	**88%**	**12%**
II Lincomycin-spectinomycin	0%	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
No antimicrobials used at the hatchery	10%	27%	**17%**	**19%**	**93%**	91%	**26%**	**41%**	**93%**	**17%**	**13%**	**88%**

Roman numerals I and II indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Numbers per column may not add up to 100% due to rounding or batches of chicks (hatched at the same time to supply 1 barn) may have used more than one antimicrobial.
Data represent flocks medicated at the hatchery at day 18 of incubation or upon hatch.
For the temporal analyses within province, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in 2016 (national program started) and previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) within province for a given antimicrobial. The presence of red areas indicates significant provincial differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial differences ($P \leq 0.05$) for a given antimicrobial.
Please note that the "no antimicrobials used" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories I and II).

Antimicrobial use *in ovo* or subcutaneous injection by quantitative indicators

Figure 2. 61 Quantity of antimicrobial use *in ovo* or subcutaneous injection adjusted for population and turkey weight (mg/PCU), 2014 to 2018



Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Antimicrobial												
II Gentamicin	0.14	0.12	0.13	0.14	0.02	0.01	0.13	0.09	0.01	0.11	0.11	0.02
Total	**0.14**	**0.12**	**0.13**	**0.14**	**0.02**	**0.01**	**0.13**	**0.09**	**0.01**	**0.11**	**0.11**	**0.02**

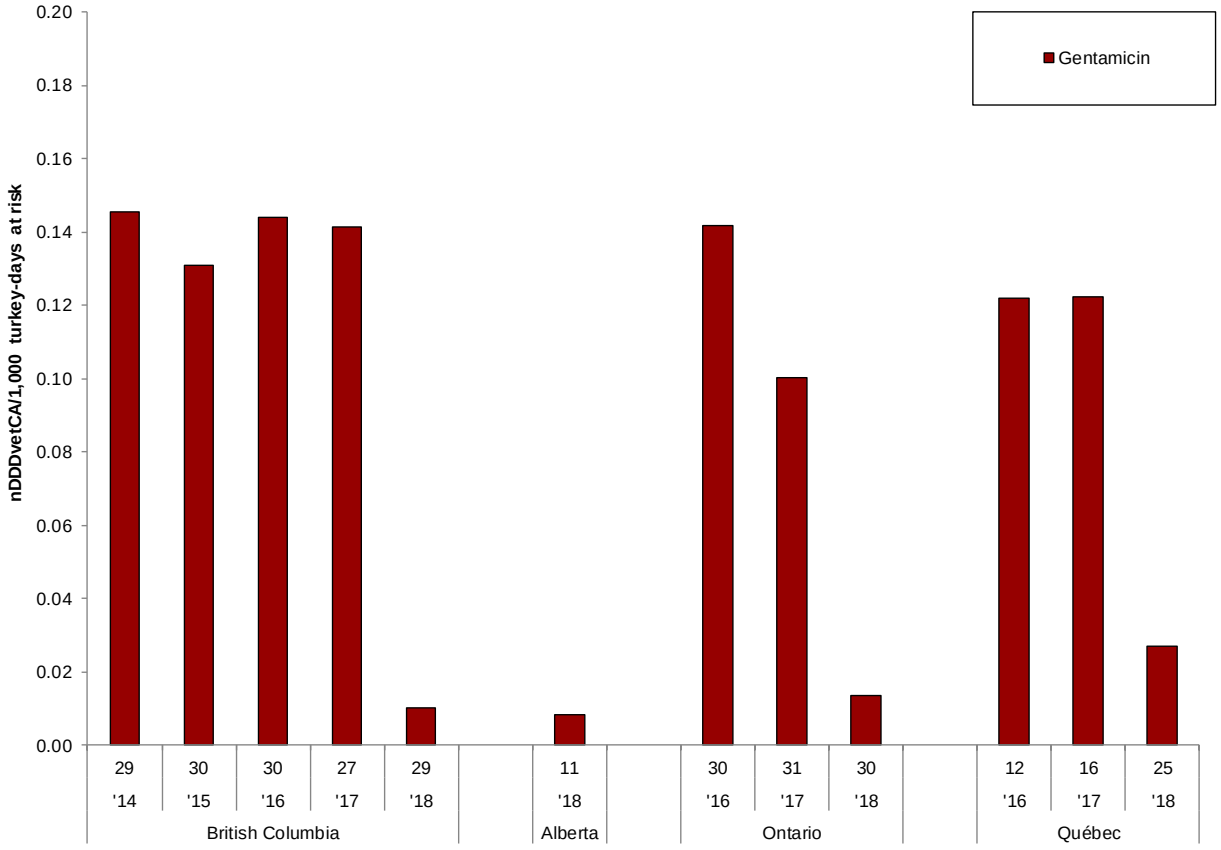
Roman numeral II indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate.

Total milligrams active ingredient was calculated using the final dose (in milligrams per hatching egg or poult) suggested by the manufacturer and expert opinion based on milligrams per body weight or residue avoidance information: gentamicin routine dose (1 mg/poult).

mg/PCU = milligrams/population correction unit.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Figure 2. 62 Number of Canadian Defined Daily Doses for animals per 1,000 turkey-days at risk (nDDDvetCA/1,000 turkey-days at risk) for antimicrobials administered *in ovo* or subcutaneous injection, 2014 to 2018



Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Antimicrobial												
II Gentamicin	0.15	0.13	0.14	0.14	0.01	0.01	0.14	0.10	0.01	0.12	0.12	0.03
Total	**0.15**	**0.13**	**0.14**	**0.14**	**0.01**	**0.01**	**0.14**	**0.10**	**0.01**	**0.12**	**0.12**	**0.03**

Roman numeral II indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate.

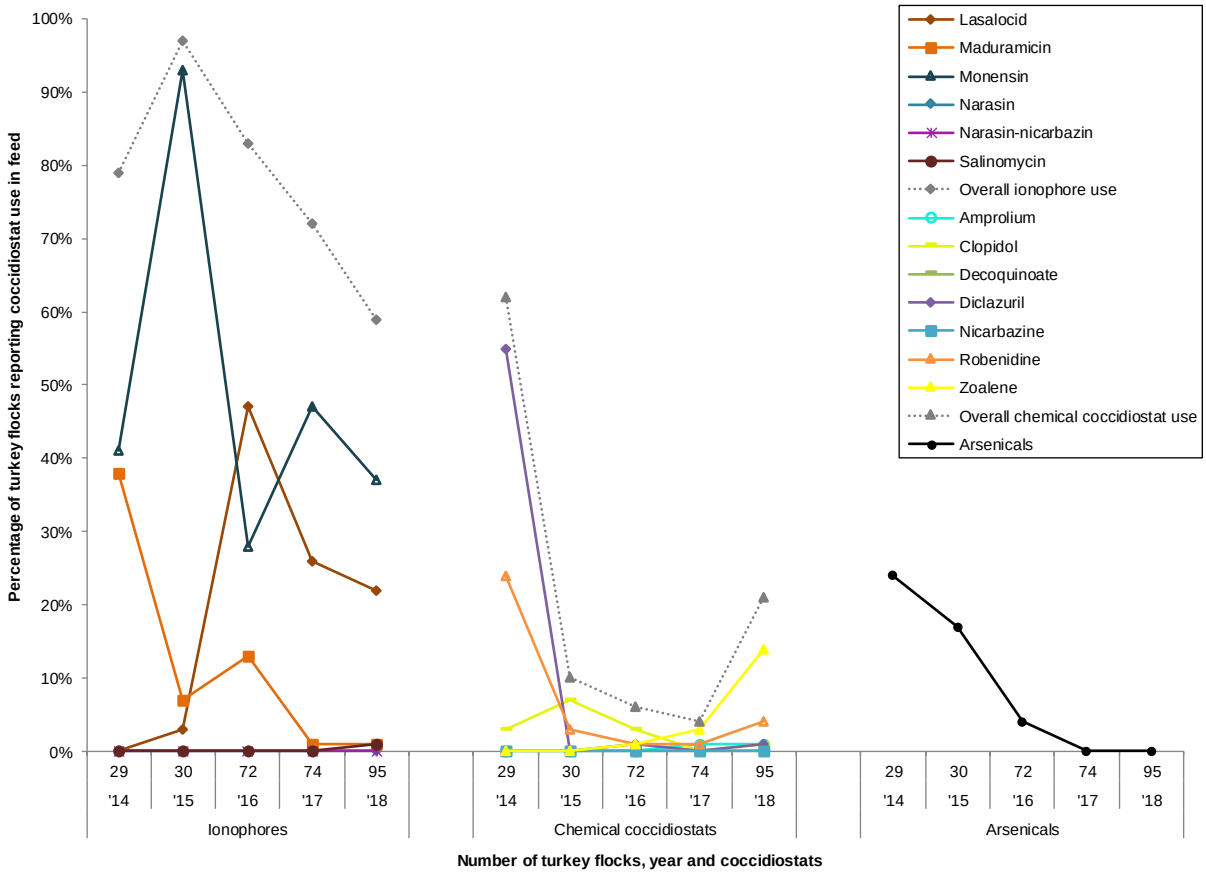
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram turkey weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2018 CIPARS Figures and Tables, Table A. 1 for the list of standards.

nDDDvetCA/1,000 turkey-days at risk = number of DDDvetCA/1,000 turkey-days at risk.

For detailed indicator descriptions, please refer to the CIPARS 2018: Design and methods document.

Coccidiostat and antiprotozoal use in feed by frequency

Figure 2. 63 Percentage of turkey flocks reporting coccidiostat and other antiprotozoals use in feed, 2014 to 2018

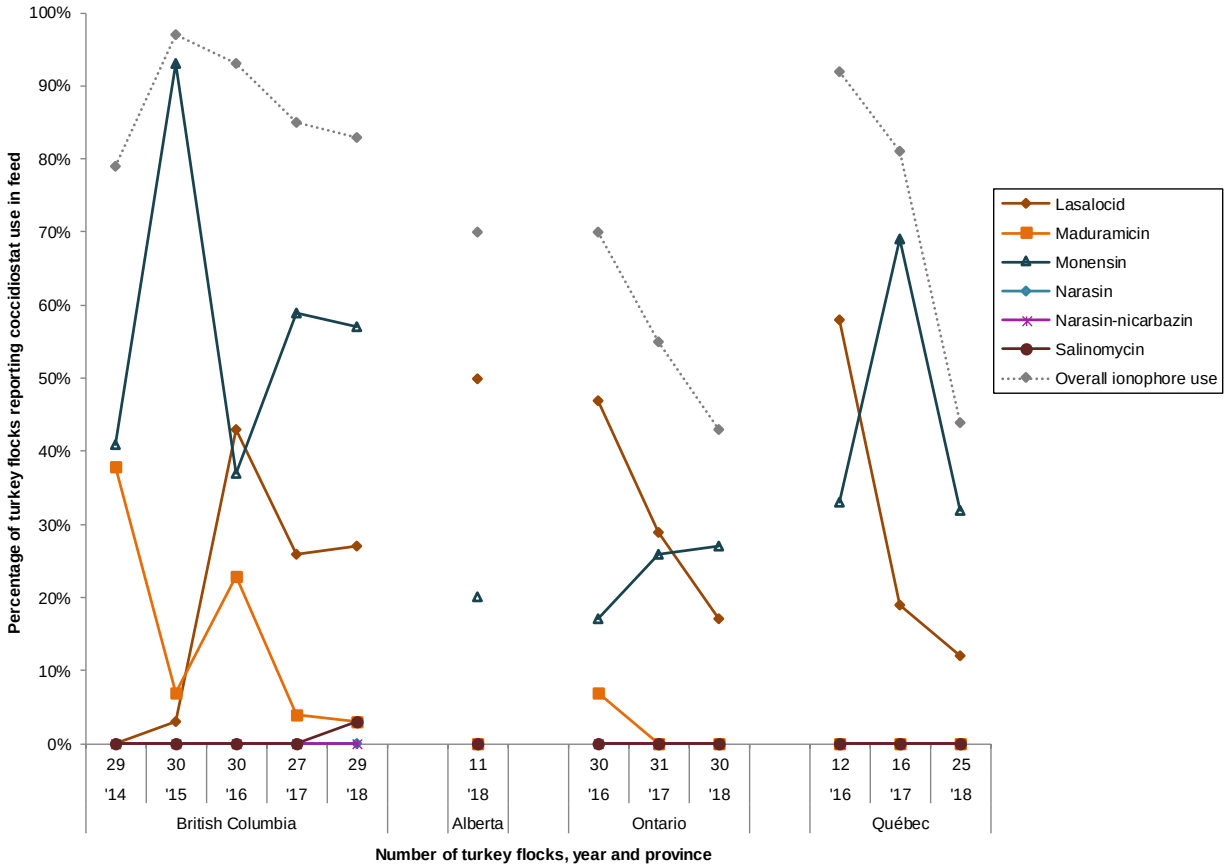


Year	2014	2015	2016	2017	2018
Number of flocks	29	30	72	74	95
Coccidiostat					
IV Lasalocid	0%	3%	**47%**	**26%**	**22%**
IV Maduramicin	38%	7%	**13%**	**1%**	**1%**
IV Monensin	41%	93%	**28%**	**47%**	**37%**
IV Narasin	0%	0%	**0%**	**0%**	**0%**
IV Narasin-nicarbazin	0%	0%	**0%**	**0%**	**0%**
IV Salinomycin	0%	0%	**0%**	**0%**	**1%**
IV **Overall ionophore use**	79%	97%	**83%**	**72%**	**59%**
N/A Amprolium	0%	0%	**0%**	**1%**	**1%**
N/A Clopidol	3%	7%	**3%**	**0%**	**1%**
N/A Decoquinoate	0%	0%	**0%**	**0%**	**0%**
N/A Diclazuril	55%	0%	**1%**	**0%**	**1%**
N/A Nicarbazine	0%	0%	**0%**	**0%**	**0%**
N/A Robenidine	24%	3%	**1%**	**1%**	**4%**
N/A Zoalene	0%	0%	**1%**	**3%**	**14%**
N/A **Overall chemical coccidiostat use**	62%	10%	**6%**	**4%**	**21%**
N/A **Arsenicals**	24%	17%	**4%**	**0%**	**0%**

Roman numeral IV indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).

For the temporal analyses, the proportion (%) of flocks using a specific coccidiostat in the current year has been compared to the proportion (%) of flocks using the same coccidiostat in 2016 (national program started) and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given coccidiostat.

Figure 2. 64 Percentage of turkey flocks reporting ionophore coccidiostat use in feed by province, 2014 to 2018

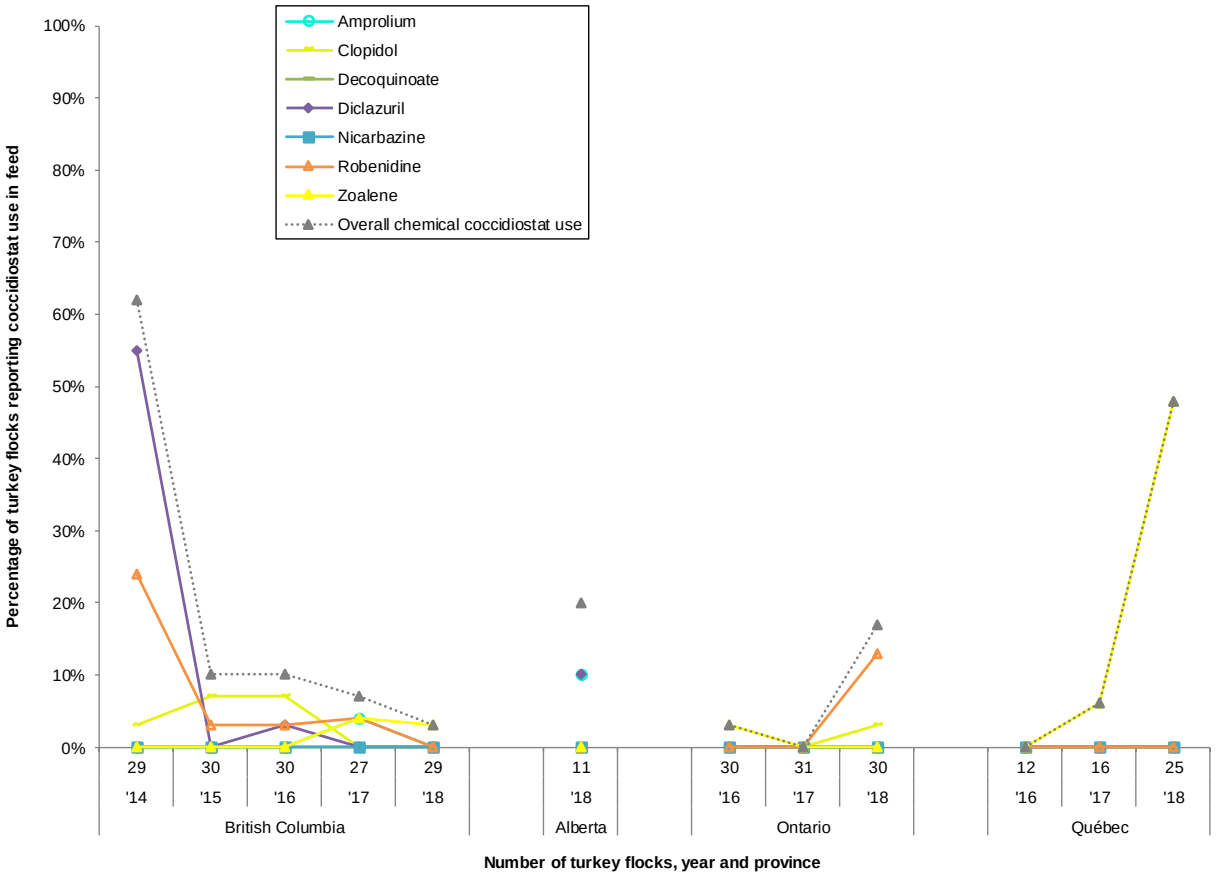


Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks	29	30	30	27	29	11	30	31	30	12	16	25
Coccidiostat												
Lasalocid	0%	3%	**43%**	**26%**	**27%**	**50%**	**47%**	**29%**	**17%**	**58%**	**19%**	**12%**
Maduramicin	38%	7%	**23%**	**4%**	**3%**	0%	**7%**	**0%**	**0%**	**0%**	**0%**	**0%**
Monensin	41%	93%	**37%**	**59%**	**57%**	20%	**17%**	**26%**	**27%**	**33%**	**69%**	**32%**
IV Narasin	0%	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Narasin-nicarbazin	0%	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Salinomycin	0%	0%	**0%**	**0%**	**3%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Overall ionophores use	79%	97%	**93%**	**85%**	**83%**	70%	**70%**	**55%**	**43%**	**92%**	**81%**	**44%**

Roman numeral IV indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate.

For the temporal analyses within province, the proportion (%) of flocks using a specific ionophore in the current year has been compared to the proportion (%) of flocks using the same ionophore in 2016 (national program started) and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province ($P \leq 0.05$) for a given ionophore. The presence of red areas indicates significant provincial differences ($P \leq 0.05$) for a given ionophore within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial differences ($P \leq 0.05$) for a given ionophore.

Figure 2. 65 Percentage of turkey flocks reporting coccidiostats and other antiprotozoals use in feed by province, 2014 to 2018



Province		British Columbia					Alberta	Ontario			Québec		
Year		'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of flocks		29	30	30	27	29	11	30	31	30	12	16	25
Coccidiostat													
N/A	Amprolium	0%	0%	**0%**	**4%**	**0%**	10%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
	Clopidol	3%	7%	**7%**	**0%**	**0%**	0%	**0%**	**0%**	**3%**	**0%**	**0%**	**0%**
	Decoquinoate	0%	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
	Diclazuril	55%	0%	**3%**	**0%**	**0%**	10%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
	Nicarbazine	0%	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
	Robenidine	24%	3%	**3%**	**4%**	**0%**	0%	**0%**	**0%**	**13%**	**0%**	**0%**	**0%**
	Zoalene	0%	0%	**0%**	**4%**	**3%**	0%	**3%**	**0%**	**0%**	**0%**	**6%**	**48%**
	Overall chemical coccidiostat use	62%	10%	**10%**	**7%**	**3%**	20%	**3%**	**0%**	**17%**	**0%**	**6%**	**48%**

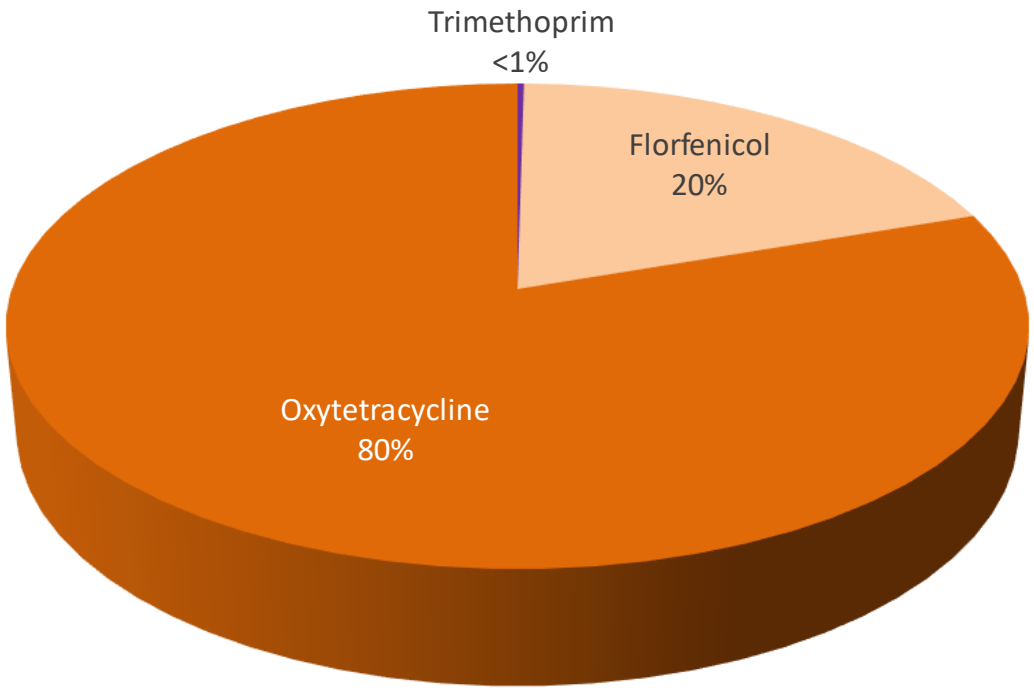
N/A = not applicable (no classification at the time of writing of this report).

For the temporal analyses within province, the proportion (%) of flocks using a specific chemical coccidiostat in the current year has been compared to the proportion (%) of flocks using the same chemical coccidiostat in 2016 (national program started) and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province ($P \leq 0.05$) for a given chemical coccidiostat. The presence of red areas indicates significant provincial differences ($P \leq 0.05$) for a given chemical coccidiostat within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given chemical coccidiostat.

Marine and freshwater finfish

Summary of antimicrobials use by all routes of administration

Figure 2. 66 Relative quantities (kg) of antimicrobials used in land-based and freshwater net pen facilities and marine finfish, 2017



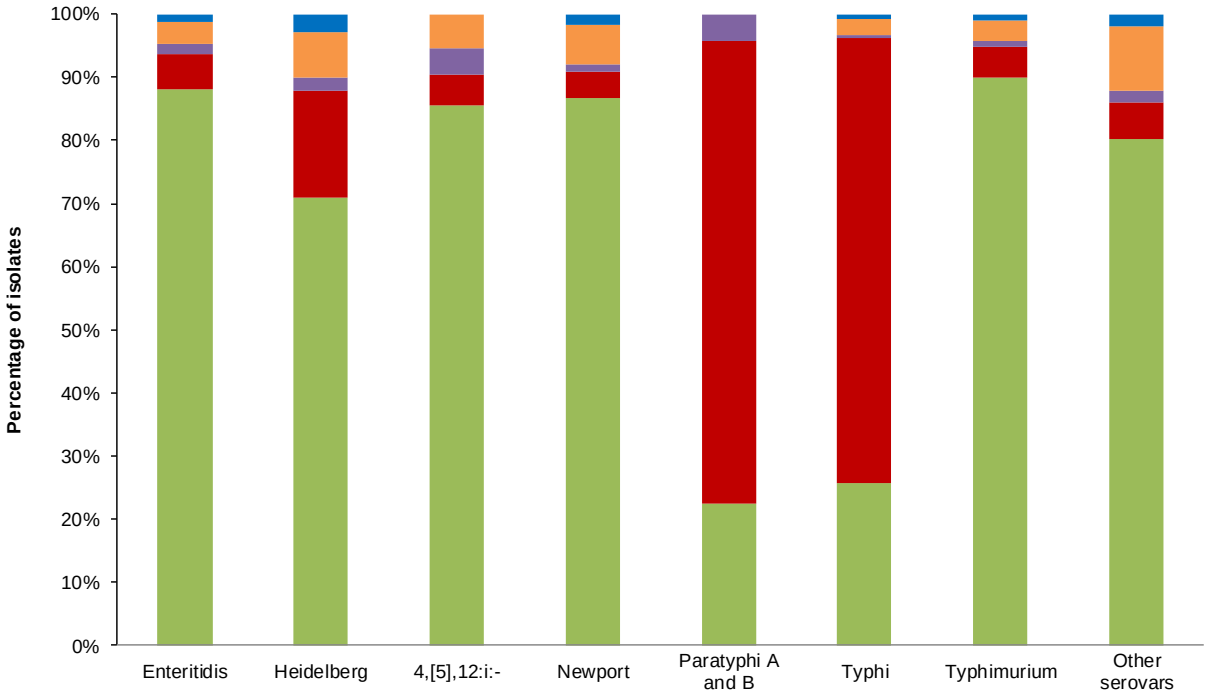
Data sources: Fisheries and Oceans Canada (https://open.canada.ca/data/en/dataset/288b6dc4-16dc-43cc-80a4-2a45b1f93383 Marine Finfish Data 2017 and Land-based and Freshwater Data 2017). Accessed on June 15, 2019.

Chapter 3 Antimicrobial resistance

Human Surveillance

Serovar distribution

Figure 3. 1 Proportion of human *Salmonella* serovars from all sample sources, 2018



	Enteritidis	Heidelberg	4,[5],12:i:-	Newport	Paratyphi A and B	Typhi	Typhimurium	Other serovars
Other	20	7	0	3	0	2	3	25
Urine	61	17	8	12	0	6	10	142
Unknown	29	5	6	2	3	1	3	24
Blood	97	40	7	8	52	172	15	78
Stool	1517	169	124	163	16	63	277	1095

Salmonella Paratyphi B does not include *S*. Paratyphi B var. L (+) tartrate (+), formerly called *S*. Paratyphi var. Java. The biotype of *S*. Paratyphi B included here is tartrate (-) and associated with severe typhoid-like fever. *Salmonella* Paratyphi B var. L (+) tartrate (+) is commonly associated with gastrointestinal illness.

Multiclass resistance

Table 3. 1 Number of antimicrobial classes in resistance patterns of *Salmonella* serovars, 2018

Province or region/serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial													
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
British Columbia																				
Enteritidis	89 (34.2)	71	14	2	2			1	3					2	1		2	1	9	8
Typhi	43 (16.5)	3	35	3	2			4	3		1			2	2		2	8	40	
Newport	24 (9.2)	17		1	2	4		4	4					7	7	6	6			7
Other serovars	44 (16.9)	38	1	1	3	1	1	3	5	2	2	1		4			3	2	3	5
Typhimurium	20 (7.7)	8	1	2	7	2	1	10	9	2		2		10	3	2	7	2		10
Paratyphi A and B	20 (7.7)	1	18	1				1										3	19	
4,[5],12:i:-	14 (5.4)	4		5	4	1		9	8					9	1		3		1	7
Heidelberg	6 (2.3)	4	2					2												
Total	**260 (100)**	**146**	**71**	**15**	**20**	**8**	**2**	**34**	**32**	**4**	**3**	**3**		**34**	**14**	**8**	**23**	**16**	**72**	**37**
Alberta																				
Enteritidis	113 (42.3)	96	14	3														2	13	7
Typhimurium	32 (12.0)	18	1	5	8			11	9	1	1	1		13	2		9			9
Newport	30 (11.2)	22		3	2	3	2	5	5					6	5	4	4		1	8
Other serovars	27 (10.1)	20		2	3	2		6	5	2	4	2		6	2		5		3	6
Typhi	23 (8.6)	4	15	3	1			4	1					1	1		1	7	19	
4,[5],12:i:-	18 (6.7)	6	1		10	1	2	11	11					11	3		1		5	11
Heidelberg	17 (6.4)	7	8	1	1		1	8	2	2	2	2		1	1		1			3
Paratyphi A and B	7 (2.6)	1	6															2	6	
Total	**267 (100)**	**174**	**45**	**17**	**25**	**6**	**5**	**45**	**33**	**5**	**7**	**5**		**38**	**14**	**4**	**21**	**11**	**47**	**44**
Saskatchewan																				
Enteritidis	94 (62.2)	78	13	3					1					1	1				12	6
Typhimurium	26 (17.2)	9		3	14			14	14					17	1		14		2	15
Heidelberg	10 (6.6)	6	2	1	1			3	3	1	1	1		1						1
Other serovars	8 (5.3)	2	1	1	3	1	2	4	6	3	5	3		4	1		2	1	4	4
4,[5],12:i:-	7 (4.6)	2			5		1	4	4		1			5	2		3			5
Newport	4 (2.6)	4																		
Typhi	2 (1.3)	1	1																1	
Total	**151 (100)**	**102**	**17**	**8**	**23**	**1**	**3**	**25**	**28**	**4**	**7**	**4**		**28**	**5**		**19**	**1**	**19**	**31**
Manitoba																				
Enteritidis	126 (65.3)	90	31	4	1			1	1					3	2			3	30	11
Typhimurium	17 (8.8)	10	1	3	3			2	5					6	4		3		1	4
Other serovars	16 (8.3)	15			1			1						1	1		1		1	1
Typhi	9 (4.7)		7	2				2											9	
4,[5],12:i:-	8 (4.1)	1		2	3	2	2	6	5					7	2		3		2	6
Newport	7 (3.6)	6				1		1	1					1	1	1	1			1
Heidelberg	6 (3.1)	2	3	1				1	3					1						1
Paratyphi A and B	4 (2.1)	3		1			1	1						1						1
Total	**193 (100)**	**127**	**42**	**13**	**8**	**3**	**3**	**15**	**15**					**20**	**10**	**1**	**8**	**3**	**43**	**25**
Ontario																				
Enteritidis	298 (33.0)	201	85	7	5		1	7	6					7	1		1	3	88	13
Typhi	152 (16.8)	11	105	10	24	2		38	25		7			26	26		27	27	136	3
Typhimurium	120 (13.3)	87	4	4	22	3	3	25	22	2	2	1		26	11	3	23	4	7	28
Heidelberg	93 (10.3)	66	17	10			5	21	8	5	5	5		7	2				1	1
Newport	80 (8.8)	77		1		2		2	2					3	3	2	3			3
Other serovars	83 (9.2)	43	2	7	17	14	12	31	33		18			34	14	1	14	16	38	36
4,[5],12:i:-	45 (5.0)	15	3	6	18	3	4	23	21		1			27	4	4	5	2	1	28
Paratyphi A and B	33 (3.6)		29	4				1	2								1	8	33	1
Total	**904 (100)**	**500**	**245**	**49**	**86**	**24**	**25**	**148**	**119**	**7**	**33**	**6**		**130**	**61**	**10**	**74**	**60**	**304**	**113**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Salmonella Paratyphi B does not include *S*. Paratyphi B var. L (+) tartrate (+), formerly called *S*. Paratyphi var. Java. The biotype of *S*. Paratyphi B included here is tartrate (-) and associated with severe typhoid-like fever. *Salmonella* Paratyphi B var. L (+) tartrate (+) is commonly associated with gastrointestinal illness.

Table 3. 1 Number of antimicrobial classes in resistance patterns of *Salmonella* serovars, 2018 (continued)

Province or region/serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial												
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Québec																				
Enteritidis	134(35.8)	97	34	3					2					1	1			3	36	2
Typhimurium	61 (16.3)	31	2	2	22	4	1	27	26		1			27	5		24	1	5	28
Heidelberg	49 (13.1)	38	6	5			2	8	5	2	2	2		2	1	1				1
4,[5],12:i:-	41 (11.0)	19	1	3	18		3	21	19					20	3		4		2	21
Newport	39 (10.4)	30		2	1	6		8	6					9	9	7	7		1	9
Other serovars	34 (9.1)	22		2	5	5	1	10	10	3	7	2		10	4		10	3	8	11
Typhi	14 (3.7)	4	9	1				2										1	9	
Paratyphi A and B	2 (0.5)		2																2	
Total	**374 (100)**	**241**	**54**	**18**	**46**	**15**	**7**	**76**	**68**	**5**	**10**	**4**		**69**	**23**	**8**	**45**	**8**	**63**	**72**
New Brunswick																				
Enteritidis	101 (62.4)	68	32		1				2			1				1	1	5	26	4
Heidelberg	19 (11.7)	9	5	3	2		3	7	4	1	1	1		4			1		1	3
Other serovars	19 (11.7)	15	2	1	1		1	1	2	1	1			2	1		1		2	1
Typhimurium	15 (9.3)	11	1		2	1		4	3					3			3		1	3
4,[5],12:i:-	6 (3.7)	2	2		1	1	1	2	2					2	1	1	1	1		4
Newport	2 (1.23)	2																		
Total	**162 (100)**	**107**	**42**	**4**	**7**	**2**	**5**	**14**	**13**	**2**	**2**	**2**		**11**	**2**	**2**	**7**	**6**	**30**	**15**
Nova Scotia																				
Enteritidis	120 (70.2)	89	25	5	1			2	2					2			1	2	23	11
Heidelberg	28 (16.4)	13	12	3			2	7	9	4	6	4		3	1					1
Typhimurium	11 (6.4)	5		1	5		1	6	5					6			5			6
Other serovars	10 (5.8)	7	1		2		1	2	1		1			2					2	2
4,[5],12:i:-	1 (0.6)	1																		
Newport	1 (0.6)		1						1											
Total	**171 (100)**	**115**	**39**	**9**	**8**		**4**	**17**	**18**	**4**	**7**	**4**		**13**	**1**		**6**	**2**	**25**	**20**
Prince Edward Island																				
Enteritidis	13 (56.5)	8	4		1			1	1					1				1	2	3
Heidelberg	4 (17.4)	2	2					1												1
4,[5],12:i:-	3 (13.0)				3			3	3					3						3
Typhimurium	2 (8.7)	1			1			1	1					1			1			1
Newport	1 (4.35)			1										1	1					1
Total	**23 (100)**	**11**	**6**	**1**	**5**			**6**	**5**					**6**	**1**		**1**	**1**	**2**	**9**
Newfoundland and Labrador																				
Enteritidis	45 (72.6)	38	7																7	
Other serovars	8 (12.9)	7			1			1						1	1		1		1	1
Heidelberg	3 (4.8)	1	1	1			1	2						1						
Typhimurium	3 (4.8)	2			1			1	1					1			1			1
4,[5],12:i:-	2 (3.2)				2			2	2					2						2
Newport	1 (1.6)	1																		
Total	**62 (100)**	**49**	**8**	**1**	**4**		**1**	**6**	**3**					**5**	**1**		**2**		**8**	**4**
National																				
Enteritidis	1,133 (44.1)	836	259	27	11		1	12	18			1		17	6	1	5	20	246	65
Typhimurium	307 (12.0)	182	10	20	85	10	6	101	95	5	4	4		110	26	5	90	7	16	105
Typhi	243 (9.5)	23	172	19	27	2		50	29		8			29	29		30	43	214	3
Heidelberg	235 (9.1)	148	58	25	4		14	60	34	15	17	15		20	5	1	2		2	12
Other serovars	249 (9.7)	169	7	14	36	23	18	59	62	11	38	8		64	24	1	37	22	62	67
Newport	189 (7.4)	159	1	8	5	16	2	20	19					27	26	20	21		2	29
4,[5],12:i:-	145 (5.7)	50	7	16	64	8	13	81	75		2			86	16	5	20	3	11	87
Paratyphi A and B	66 (2.6)	5	55	6			1	3	2					1			1	13	60	2
Total	**2,567**	**1,572**	**569**	**135**	**232**	**59**	**55**	**386**	**334**	**31**	**69**	**28**		**354**	**132**	**33**	**206**	**108**	**613**	**370**

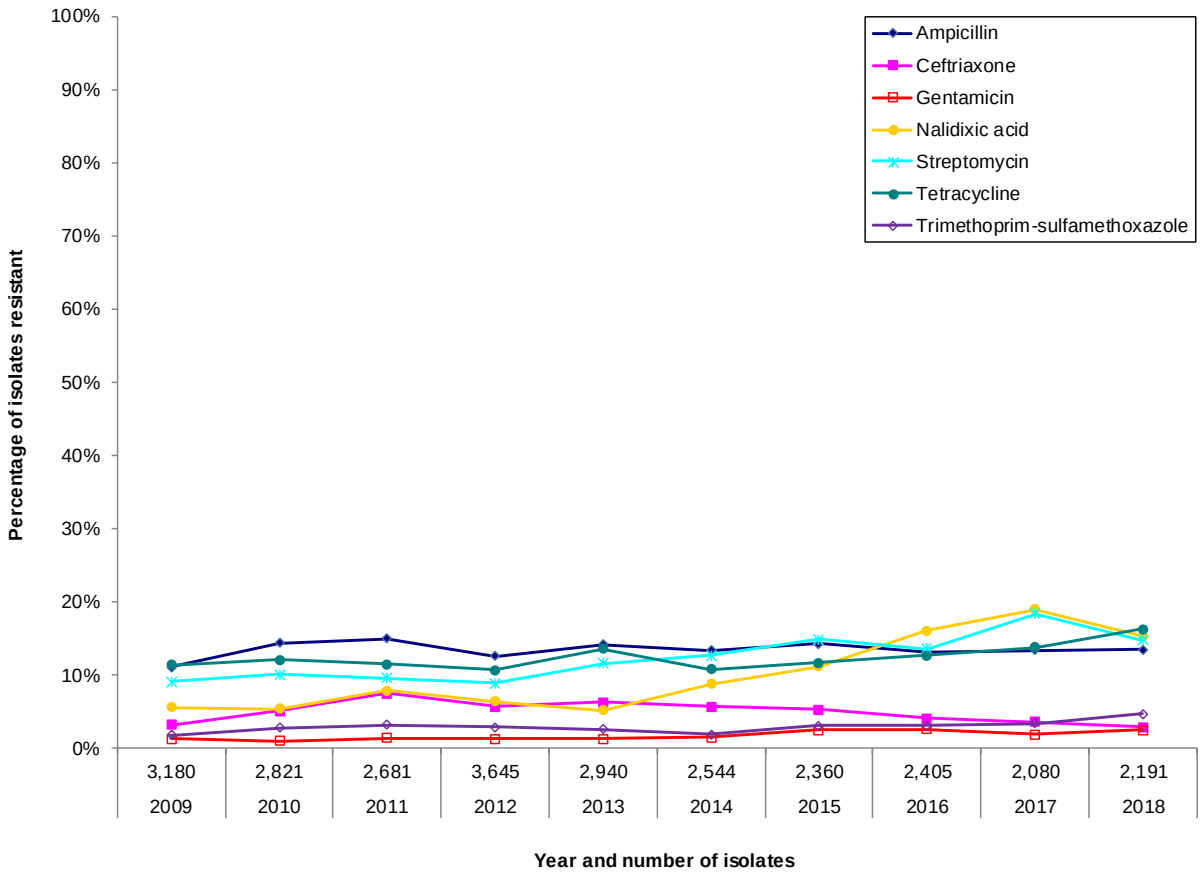
Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Salmonella Paratyphi B does not include *S*. Paratyphi B var. L (+) tartrate (+), formerly called *S*. Paratyphi var. Java. The biotype of *S*. Paratyphi B included here is tartrate (-) and associated with severe typhoid-like fever. *Salmonella* Paratyphi B var. L (+) tartrate (+) is commonly associated with gastrointestinal illness.

Temporal antimicrobial resistance summary

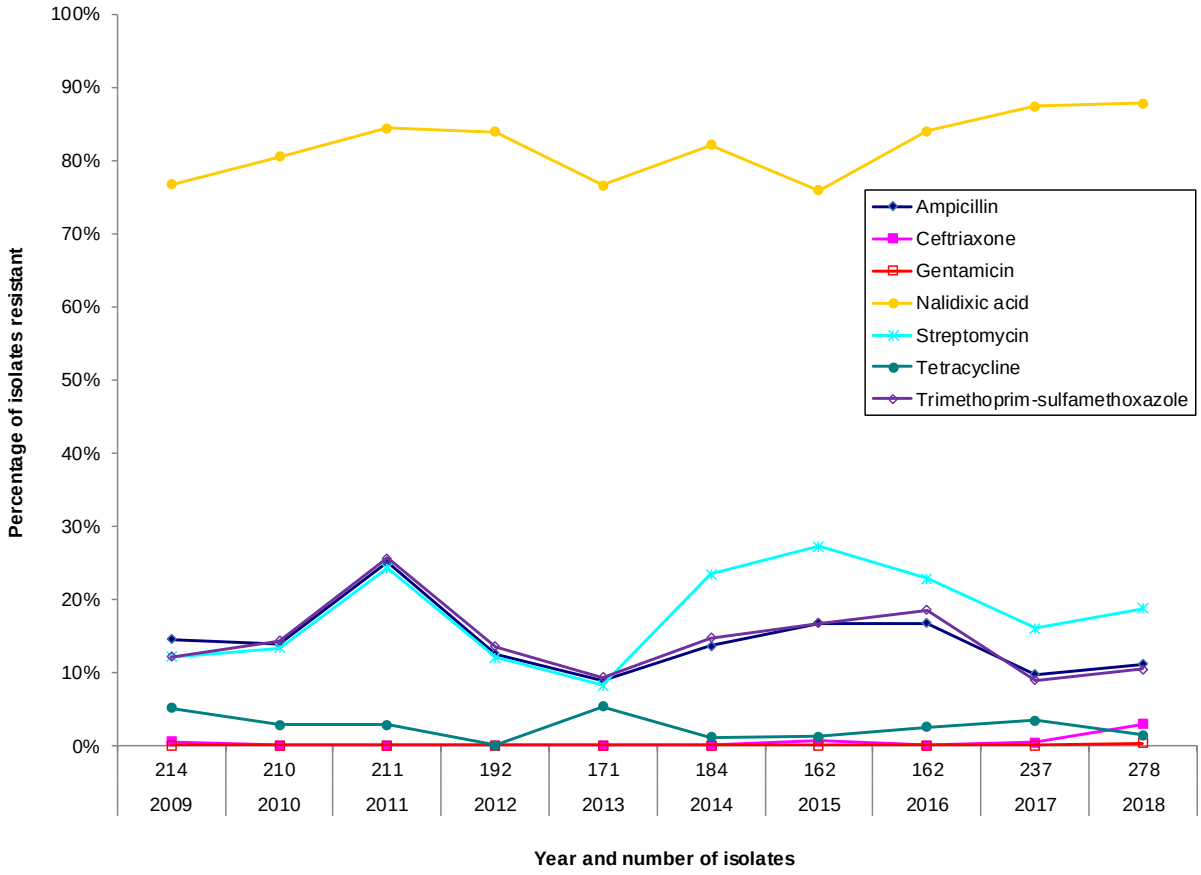
Figure 3. 2 Temporal variations in resistance of non-typhoidal *Salmonella* from humans, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	3,180	2,821	2,681	3,645	2,940	2,544	2,360	2,405	2,080	2,191
Antimicrobial										
Ampicillin	**11%**	14%	15%	13%	14%	13%	14%	13%	**13%**	**13%**
Ceftriaxone	**3%**	5%	7%	6%	6%	6%	5%	4%	**4%**	**3%**
Gentamicin	**1%**	1%	1%	1%	1%	1%	2%	2%	**2%**	**2%**
Nalidixic acid	**6%**	5%	8%	6%	5%	9%	11%	16%	**19%**	**15%**
Streptomycin	**9%**	10%	10%	9%	11%	13%	15%	14%	**18%**	**15%**
Tetracycline	**11%**	12%	11%	11%	14%	11%	12%	13%	**14%**	**16%**
Trimethoprim-sulfamethoxazole	**2%**	3%	3%	3%	3%	2%	3%	3%	**3%**	**5%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

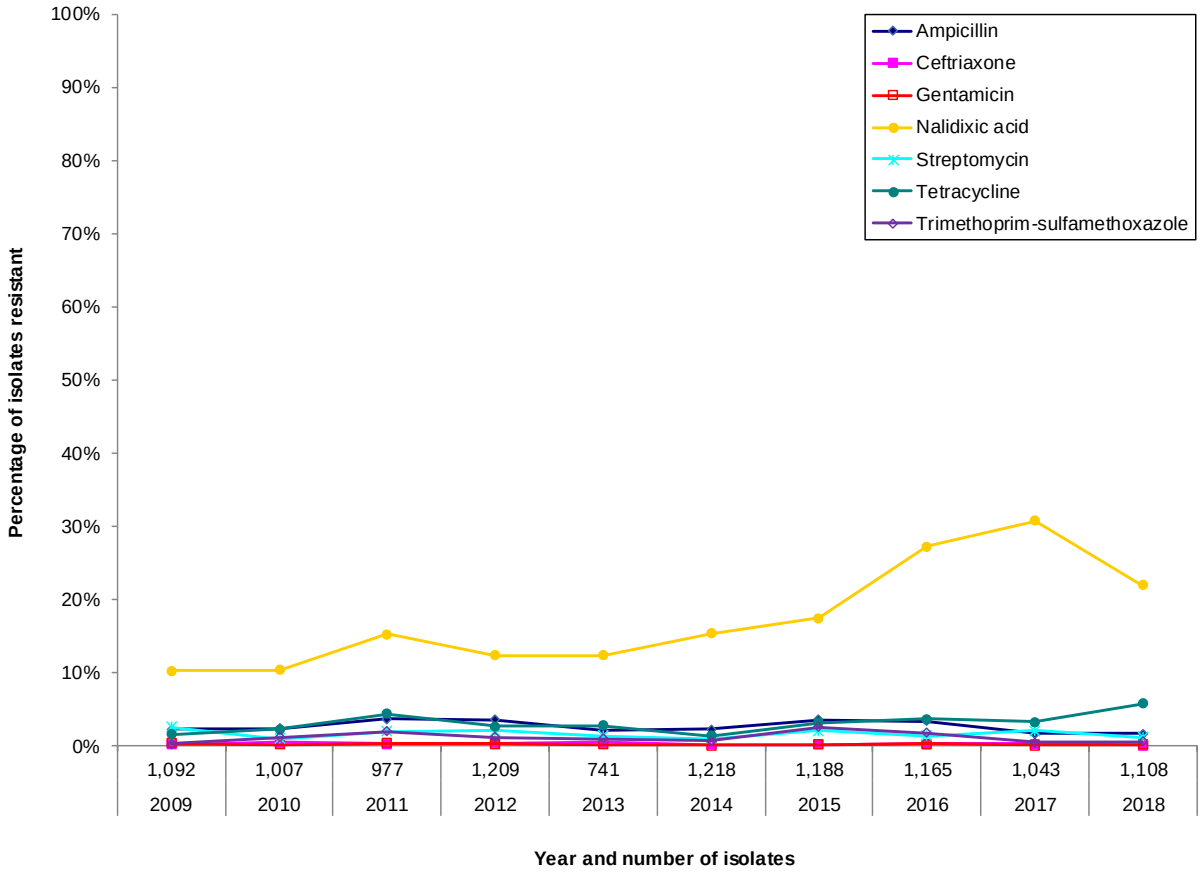
Figure 3. 3 Temporal variations in resistance of typhoidal *Salmonella* from humans, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	214	210	211	192	171	184	162	162	237	278
Antimicrobial										
Ampicillin	**14%**	14%	25%	13%	9%	14%	17%	17%	**10%**	**11%**
Ceftriaxone	**0%**	0%	0%	0%	0%	0%	1%	0%	**0%**	**3%**
Gentamicin	**0%**	0%	0%	0%	0%	0%	0%	0%	**0%**	**0%**
Nalidixic acid	**77%**	80%	84%	84%	77%	82%	76%	84%	**87%**	**88%**
Streptomycin	**12%**	13%	24%	12%	8%	23%	27%	23%	**16%**	**19%**
Tetracycline	**5%**	3%	3%	0%	5%	1%	1%	2%	**3%**	**1%**
Trimethoprim-sulfamethoxazole	**12%**	14%	26%	14%	9%	15%	17%	19%	**9%**	**10%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

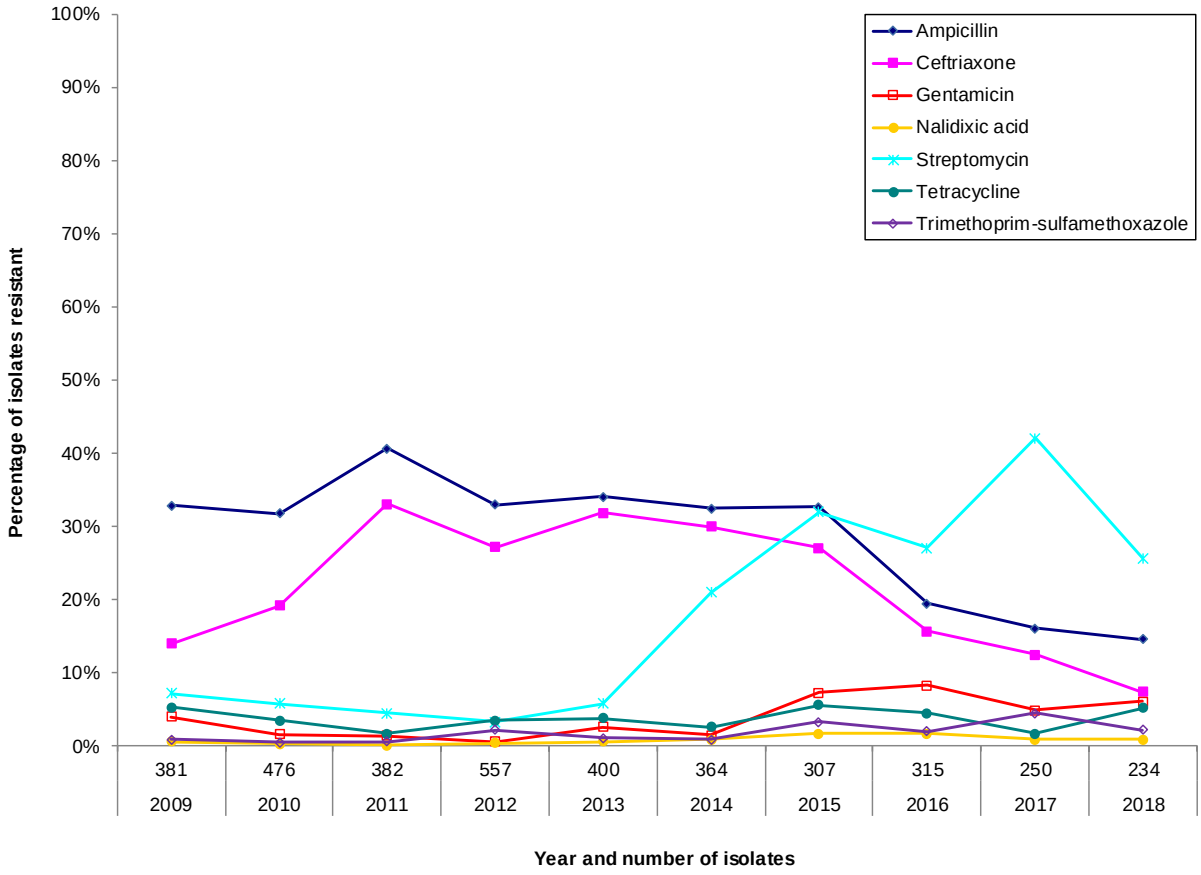
Figure 3. 4 Temporal variations in resistance of *Salmonella* Enteritidis from humans, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	1,092	1,007	977	1,209	741	1,218	1,188	1,165	1,043	1,108
Antimicrobial										
Ampicillin	**2%**	2%	4%	4%	2%	2%	4%	3%	**2%**	**2%**
Ceftriaxone	**0%**	0%	0%	0%	0%	0%	0%	0%	**0%**	**0%**
Gentamicin	**0%**	0%	0%	0%	0%	0%	0%	0%	**0%**	**0%**
Nalidixic acid	**10%**	10%	15%	12%	12%	15%	17%	27%	**31%**	**22%**
Streptomycin	**2%**	1%	2%	2%	1%	1%	2%	1%	**2%**	**1%**
Tetracycline	**1%**	2%	4%	3%	3%	1%	3%	4%	**3%**	**6%**
Trimethoprim-sulfamethoxazole	**0%**	1%	2%	1%	1%	1%	3%	2%	**0%**	**1%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

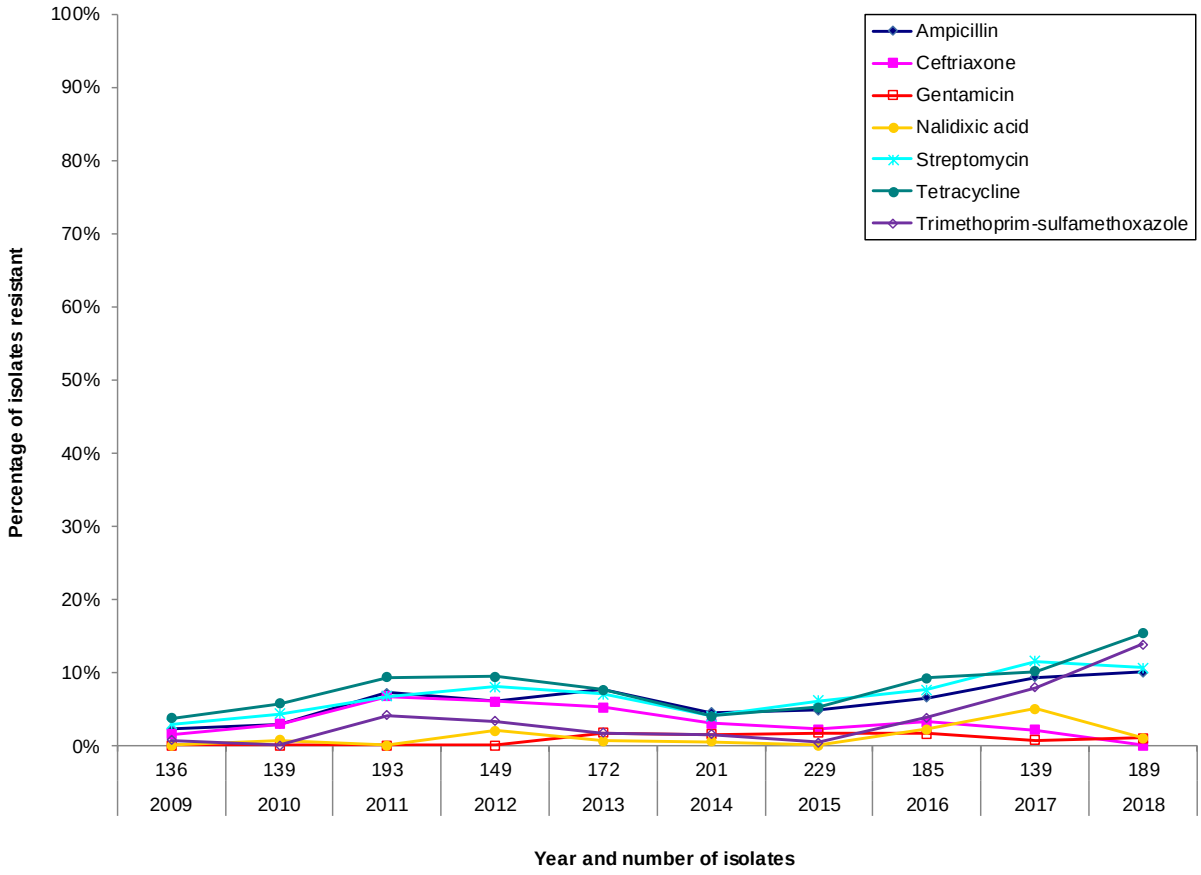
Figure 3. 5 Temporal variations in resistance of *Salmonella* Heidelberg from humans, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	381	476	382	557	400	364	307	315	250	234
Antimicrobial										
Ampicillin	**33%**	32%	41%	33%	34%	32%	33%	19%	**16%**	**15%**
Ceftriaxone	**14%**	19%	33%	27%	32%	30%	27%	16%	**12%**	**7%**
Gentamicin	**4%**	1%	1%	1%	3%	1%	7%	8%	**5%**	**6%**
Nalidixic acid	**1%**	0%	0%	0%	1%	1%	2%	2%	**1%**	**1%**
Streptomycin	**7%**	6%	4%	3%	6%	21%	32%	27%	**42%**	**26%**
Tetracycline	**5%**	3%	2%	3%	4%	2%	6%	4%	**2%**	**5%**
Trimethoprim-sulfamethoxazole	**1%**	0%	1%	2%	1%	1%	3%	2%	**4%**	**2%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

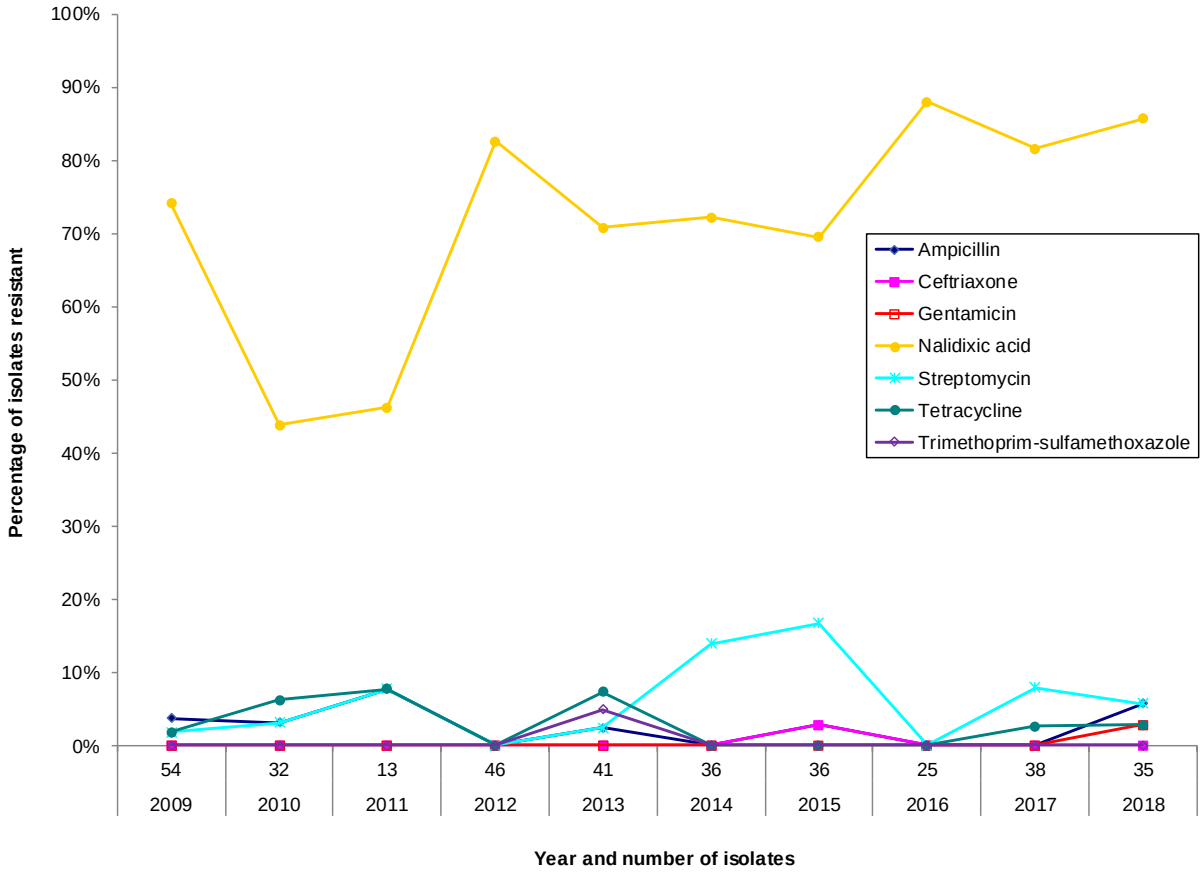
Figure 3. 6 Temporal variations in resistance of *Salmonella* Newport from humans, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	136	139	193	149	172	201	229	185	139	189
Antimicrobial										
Ampicillin	**2%**	3%	7%	6%	8%	4%	5%	6%	**9%**	**10%**
Ceftriaxone	**1%**	3%	7%	6%	5%	3%	2%	3%	**2%**	**0%**
Gentamicin	**0%**	0%	0%	0%	2%	1%	2%	2%	**1%**	**1%**
Nalidixic acid	**0%**	1%	0%	2%	1%	0%	0%	2%	**5%**	**1%**
Streptomycin	**3%**	4%	7%	8%	7%	4%	6%	8%	**12%**	**11%**
Tetracycline	**4%**	6%	9%	9%	8%	4%	5%	9%	**10%**	**15%**
Trimethoprim-sulfamethoxazole	**1%**	0%	4%	3%	2%	1%	0%	4%	**8%**	**14%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

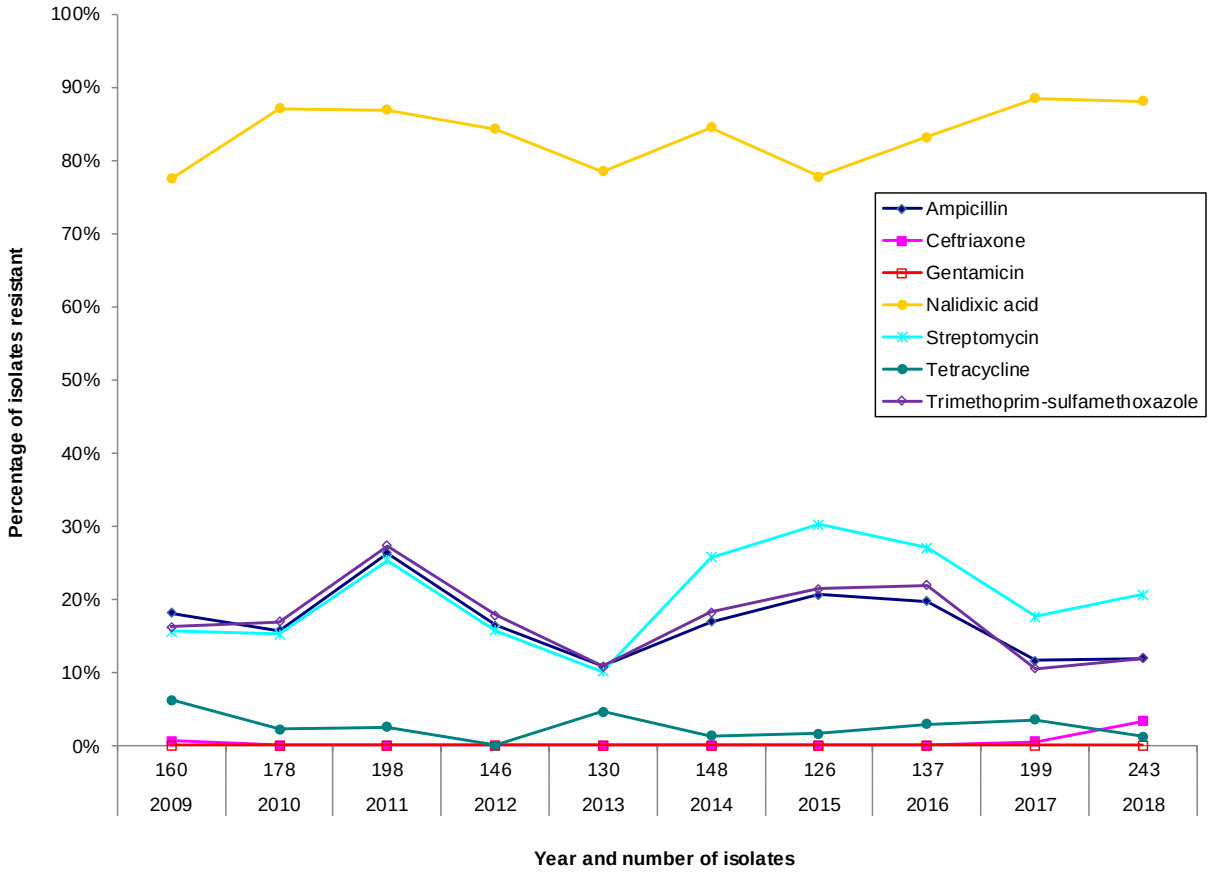
Figure 3. 7 Temporal variations in resistance of *Salmonella* Paratyphi A and B from humans, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	54	32	13	46	41	36	36	25	38	35
Antimicrobial										
Ampicillin	**4%**	3%	8%	0%	2%	0%	3%	0%	**0%**	**6%**
Ceftriaxone	**0%**	0%	0%	0%	0%	0%	3%	0%	**0%**	**0%**
Gentamicin	**0%**	0%	0%	0%	0%	0%	0%	0%	**0%**	**3%**
Nalidixic acid	**74%**	44%	46%	83%	71%	72%	69%	88%	**82%**	**86%**
Streptomycin	**2%**	3%	8%	0%	2%	14%	17%	0%	**8%**	**6%**
Tetracycline	**2%**	6%	8%	0%	7%	0%	0%	0%	**3%**	**3%**
Trimethoprim-sulfamethoxazole	**0%**	0%	0%	0%	5%	0%	0%	0%	**0%**	**0%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

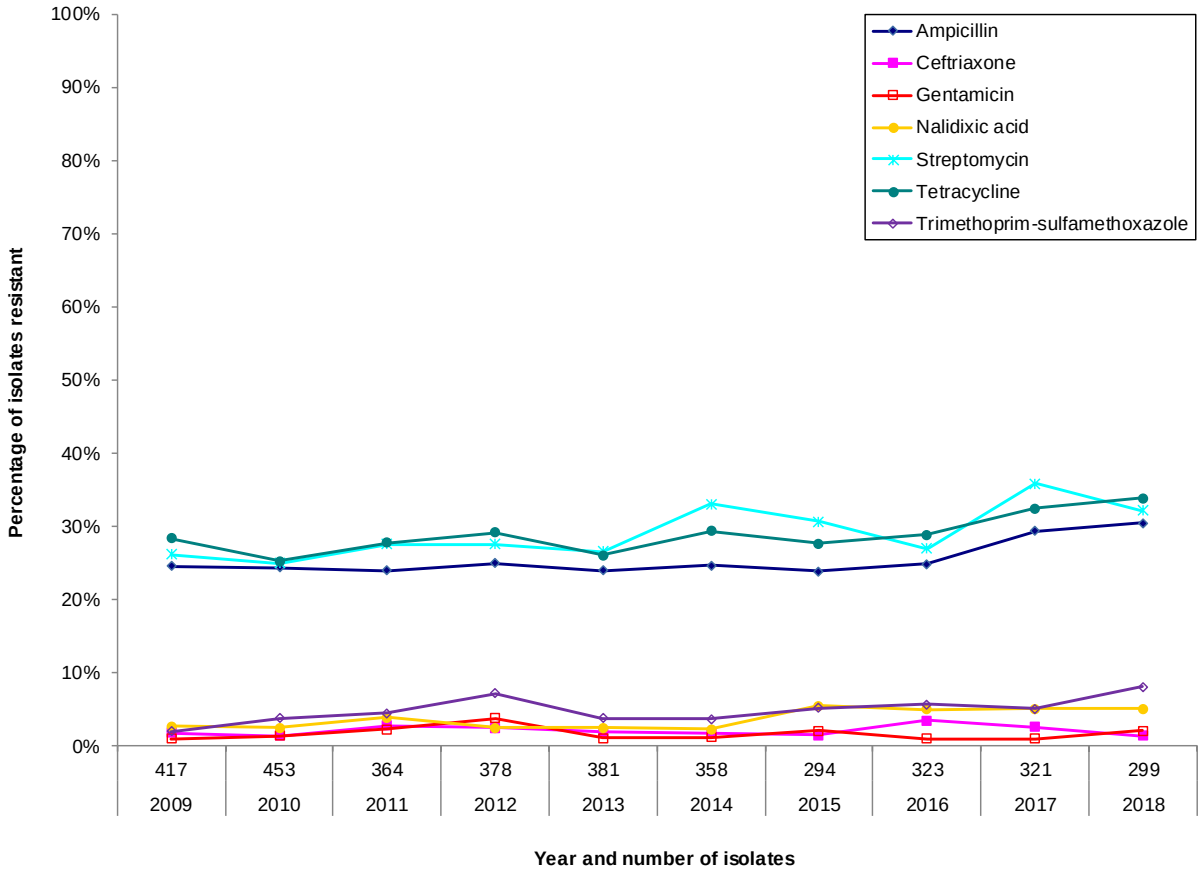
Figure 3. 8 Temporal variations in resistance of *Salmonella* Typhi from humans, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	160	178	198	146	130	148	126	137	199	243
Antimicrobial										
Ampicillin	**18%**	16%	26%	16%	11%	17%	21%	20%	**12%**	**12%**
Ceftriaxone	**1%**	0%	0%	0%	0%	0%	0%	0%	**1%**	**3%**
Gentamicin	**0%**	0%	0%	0%	0%	0%	0%	0%	**0%**	**0%**
Nalidixic acid	**78%**	87%	87%	84%	78%	84%	78%	83%	**88%**	**88%**
Streptomycin	**16%**	15%	25%	16%	10%	26%	30%	27%	**18%**	**21%**
Tetracycline	**6%**	2%	3%	0%	5%	1%	2%	3%	**4%**	**1%**
Trimethoprim-sulfamethoxazole	**16%**	17%	27%	18%	11%	18%	21%	22%	**11%**	**12%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

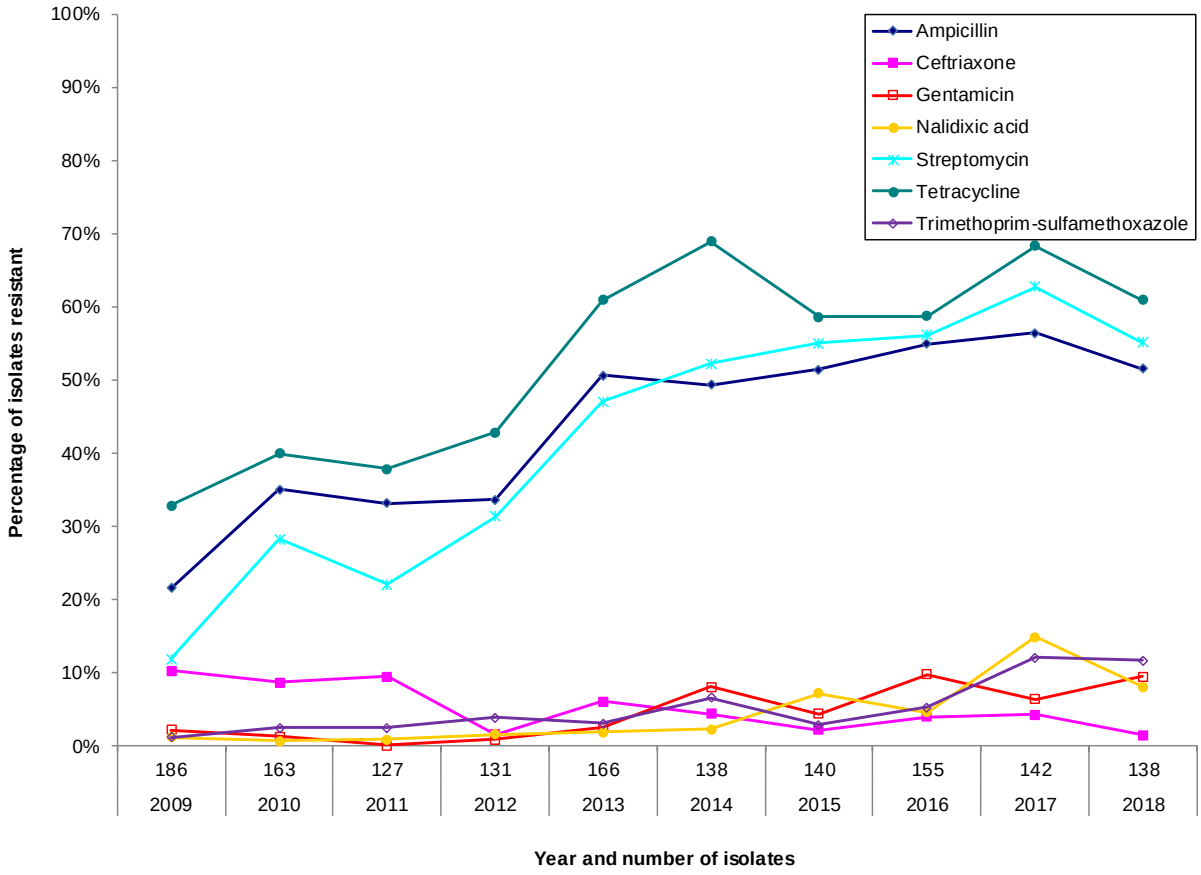
Figure 3. 9 Temporal variations in resistance of *Salmonella* Typhimurium from humans, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	417	453	364	378	381	358	294	323	321	299
Antimicrobial										
Ampicillin	**24%**	24%	24%	25%	24%	25%	24%	25%	**29%**	**30%**
Ceftriaxone	**2%**	1%	3%	2%	2%	2%	1%	3%	**2%**	**1%**
Gentamicin	**1%**	1%	2%	4%	1%	1%	2%	1%	**1%**	**2%**
Nalidixic acid	**3%**	2%	4%	2%	2%	2%	5%	5%	**5%**	**5%**
Streptomycin	**26%**	25%	27%	28%	27%	33%	31%	27%	**36%**	**32%**
Tetracycline	**28%**	25%	28%	29%	26%	29%	28%	29%	**32%**	**34%**
Trimethoprim-sulfamethoxazole	**2%**	4%	4%	7%	4%	4%	5%	6%	**5%**	**8%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

Figure 3. 10 Temporal variations in resistance of *Salmonella* 4,[5],12:i:- from humans, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	186	163	127	131	166	138	140	155	142	138
Antimicrobial										
Ampicillin	**22%**	35%	33%	34%	51%	49%	51%	55%	**56%**	**51%**
Ceftriaxone	**10%**	9%	9%	2%	6%	4%	2%	4%	**4%**	**1%**
Gentamicin	**2%**	1%	0%	1%	2%	8%	4%	10%	**6%**	**9%**
Nalidixic acid	**1%**	1%	1%	2%	2%	2%	7%	5%	**15%**	**8%**
Streptomycin	**12%**	28%	22%	31%	47%	52%	55%	56%	**63%**	**55%**
Tetracycline	**33%**	40%	38%	43%	61%	69%	59%	59%	**68%**	**61%**
Trimethoprim-sulfamethoxazole	**1%**	2%	2%	4%	3%	7%	3%	5%	**12%**	**12%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

Retail Meat Surveillance

Multiclass resistance

Table 3. 2 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from beef, 2018

Province or region	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
British Columbia	35 (28.7)	31	2	2				2						2	1				1	2
Prairies	7 (5.7)	6	1																	1
Ontario	2 (1.6)	1			1			1	1					1	1		1			1
Québec	78 (63.9)	60	8	5	4	1	1	8	6					7	4	1	4		2	16
National	**122 (100)**	**98**	**11**	**7**	**5**	**1**	**1**	**11**	**7**					**10**	**6**	**1**	**5**		**3**	**20**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields were not achieved and results should be interpreted with caution.

Table 3. 3 Number of antimicrobial classes in resistance patterns of *Salmonella* from chicken, 2018

Province or region/serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
British Columbia																				
Enteritidis	17 (53.1)	17																		
Kentucky	10 (31.3)			9	1		1	10	2	2	2	2		1						10
Schwarzengrund	2 (6.3)	2																		
Uganda	2 (6.3)	2																		
Rissen	1 (3.1)			1				1						1						1
Total	**32 (100)**	**21**		**10**	**1**		**1**	**11**	**2**	**2**	**2**	**2**		**2**						**11**
Prairies																				
Enteritidis	2 (66.7)	1	1																1	
Infantis	1 (33.3)			1			1	1						1						
Total	**3 (100)**	**1**	**1**	**1**			**1**	**1**						**1**					**1**	
Québec																				
Kentucky	33 (34.7)	1	1	31				31	5	5	5	5								32
Heidelberg	28 (29.5)	14	8	6			3	11	7	6	6	6		3	2		1			2
Enteritidis	12 (12.6)	12																		
Hadar	5 (5.3)	2		3				3												3
Infantis	3 (3.2)	3																		
Livingstone	2 (2.1)		2																	2
Newport	2 (2.1)	2																		
Schwarzengrund	2 (2.1)			2				2						2	1					2
Thompson	2 (2.1)	2																		
Less common serovars	6 (6.3)	6																		
Total	**95 (100)**	**42**	**11**	**42**			**3**	**47**	**12**	**11**	**11**	**11**		**5**	**3**		**1**			**41**
National																				
Kentucky	43 (33.1)	1	1	40	1		1	41	7	7	7	7		1						42
Enteritidis	31 (23.8)	30	1																1	
Heidelberg	28 (21.5)	14	8	6			3	11	7	6	6	6		3	2		1			2
Hadar	5 (3.8)	2		3				3												3
Infantis	4 (3.1)	3		1			1	1						1						
Schwarzengrund	4 (3.1)	2		2				2						2	1					2
Less common serovars	15 (11.5)	12	2	1				1						1						3
Total	**130 (100)**	**64**	**12**	**53**	**1**		**5**	**59**	**14**	**13**	**13**	**13**		**8**	**3**		**1**		**1**	**52**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields were not achieved and results should be interpreted with caution.

Table 3. 4 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from chicken, 2018

Province or region	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
British Columbia	47 (26.1)	13	6	13	15		16	25	25	5	6	5		23	3		1		5	24
Prairies	9 (5.0)	2		5	2		3	3	4					5	1				1	5
Ontario	2 (1.1)			2			2	2						2						
Québec	122 (67.8)	25	10	64	23		35	78	38	6	6	6		76	38		10		2	58
National	**180 (100)**	**40**	**16**	**84**	**40**		**56**	**108**	**67**	**11**	**12**	**11**		**106**	**42**		**11**		**8**	**87**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields were not achieved and results should be interpreted with caution.

Table 3. 5 Number of antimicrobial classes in resistance patterns of *Campylobacter* from chicken, 2018

Province or region/species	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial							
							Aminoglycosides	Ketolides	Lincosamides	Macrolides		Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	TEL	CLI	AZM	ERY	FLR	CIP	NAL	TET
British Columbia															
Campylobacter jejuni	29 (85.3)	15	8	6									9	9	11
Campylobacter coli	5 (14.7)	3	2										2	2	
Total	**34 (100)**	**18**	**10**	**6**									**11**	**11**	**11**
Prairies															
Campylobacter jejuni	5 (83.3)	3	1	1									1	1	2
Campylobacter coli	1 (16.7)		1												1
Total	**6 (100)**	**3**	**2**	**1**									**1**	**1**	**3**
Ontario															
Campylobacter spp.	1 (100)	1													
Total	**1 (100)**	**1**													
Québec															
Campylobacter jejuni	53 (85.5)	34	7	11	1			5	7	11	11		2	2	11
Campylobacter coli	5 (8.1)	2		3				1	3	3	3				
Campylobacter spp.	4 (6.5)	3	1												1
Total	**62 (100)**	**39**	**8**	**14**	**1**			**6**	**10**	**14**	**14**		**2**	**2**	**12**
National															
Campylobacter jejuni	87 (84.5)	52	16	18	1			5	7	11	11		12	12	24
Campylobacter coli	11 (10.7)	5	3	3				1	3	3	3		2	2	1
Campylobacter spp.	5 (4.9)	4	1												1
Total	**103 (100)**	**61**	**20**	**21**	**1**			**6**	**10**	**14**	**14**		**14**	**14**	**26**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields were not achieved and results should be interpreted with caution.

Table 3. 6 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from pork, 2018

Province or region	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
British Columbia	10 (19.6)	7	1	1	1			1	1	1	1	1		1				1	1	3
Prairies	1 (2.0)	1																		
Ontario	1 (2.0)				1			1	1					1						1
Québec	39 (76.5)	25		11	3		2	9	8	1		1		6	4		1		1	11
National	**51 (100)**	**33**	**1**	**12**	**5**		**2**	**11**	**10**	**2**	**1**	**2**		**8**	**4**		**1**	**1**	**2**	**15**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields were not achieved and results should be interpreted with caution.

Table 3. 7 Number of antimicrobial classes in resistance patterns of *Salmonella* from turkey, 2018

Province or region/serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
British Columbia																				
Reading	13 (38.2)	6	4	1	2			3	6					3						3
Enteritidis	8 (23.5)	8																		
Hadar	4 (11.8)			4				4												4
Worthington	3 (8.8)	3																		
Schwarzengrund	2 (5.9)	2																		
Uganda	2 (5.9)	2																		
Muenchen	1 (2.9)	1																		
Thompson	1 (2.9)	1																		
Total	**34 (100)**	**23**	**4**	**5**	**2**			**7**	**6**					**3**						**7**
Prairies																				
Reading	3 (100)	1	1		1			1	2					1						1
Total	**3 (100)**	**1**	**1**		**1**			**1**	**2**					**1**						**1**
Québec																				
Heidelberg	34 (44.7)	25	5	4			5	6	2	2	2	2		5	1					
Uganda	9 (11.8)	1		8				8						8						8
Reading	8 (10.5)	8																		
Schwarzengrund	5 (6.6)	4		1				1						1						1
Agona	3 (3.9)	2	1																	1
Albany	3 (3.9)	1	2				1	2												
Typhimurium	3 (3.9)	1		2				1						2						2
Enteritidis	2 (2.6)	2																		
Muenchen	2 (2.6)	1		1				1						1						1
Less common serovars	7 (9.2)	3	2	2			2	2						1	1					2
Total	**76 (100)**	**48**	**10**	**18**			**8**	**21**	**2**	**2**	**2**	**2**		**18**	**2**					**15**
National																				
Heidelberg	34 (30.1)	25	5	4			5	6	2	2	2	2		5	1					
Reading	24 (21.2)	15	5	1	3			4	8					4						4
Uganda	11 (9.7)	3		8				8						8						8
Enteritidis	10 (8.8)	10																		
Schwarzengrund	7 (6.2)	6		1				1						1						1
Hadar	4 (3.5)			4				4												4
Agona	3 (2.7)	2	1																	1
Albany	3 (2.7)	1	2				1	2												
Muenchen	3 (2.7)	2		1				1						1						1
Typhimurium	3 (2.7)	1		2				1						2						2
Worthington	3 (2.7)	3																		
Less common serovars	8 (7.1)	4	2	2			2	2						1	1					2
Total	**113 (100)**	**72**	**15**	**23**	**3**		**8**	**29**	**10**	**2**	**2**	**2**		**22**	**2**					**23**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields were not achieved and results should be interpreted with caution.

Table 3. 8 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from turkey, 2018

Province or region	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
British Columbia	49 (27.4)	15	10	18	6		5	16	14	1		1		13	6		1		1	31
Prairies	7 (3.9)	1	2	4			1	2	2					1						5
Ontario	2 (1.1)	1		1				1						1						1
Québec	121 (67.6)	47	28	33	12	1	15	38	33	4	5	3		28	7		6	1	3	53
National	**179 (100)**	**64**	**40**	**56**	**18**	**1**	**21**	**57**	**49**	**5**	**5**	**4**		**43**	**13**		**7**	**1**	**4**	**90**

Antimicrobial abbreviations are defined in the Appendix.

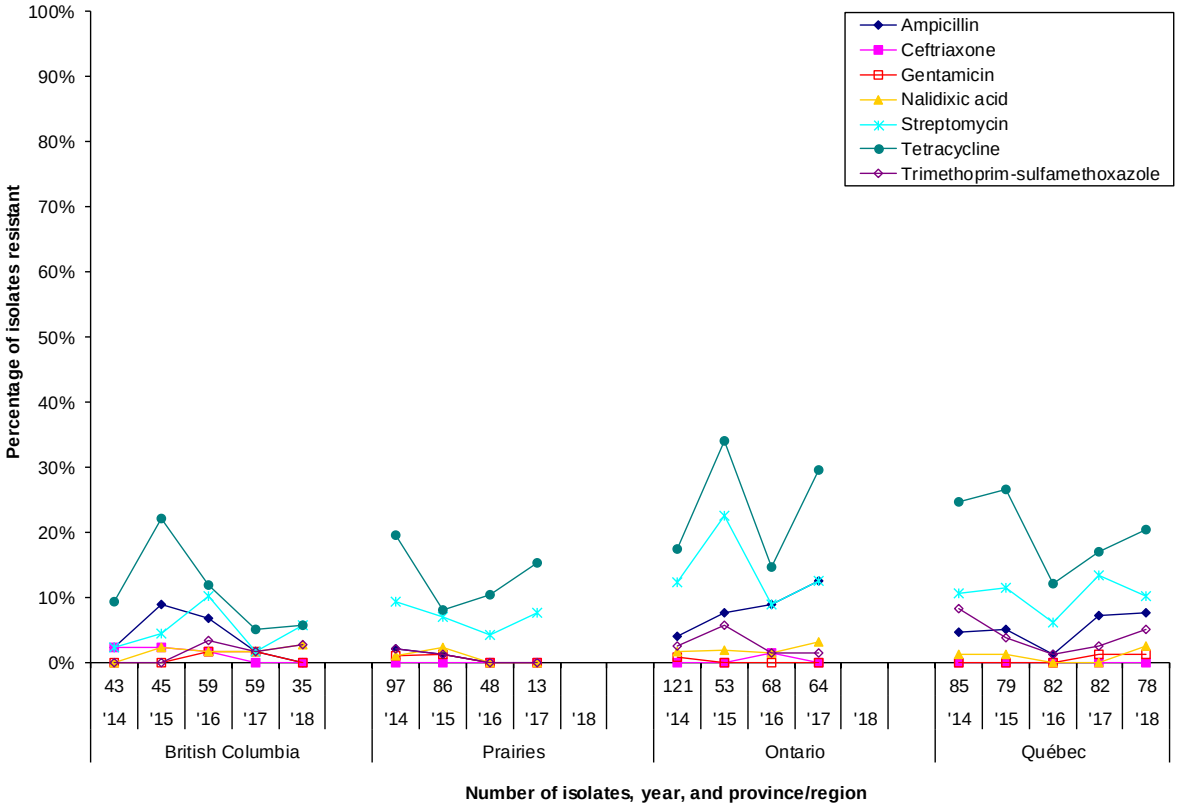
Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields were not achieved and results should be interpreted with caution.

Temporal antimicrobial resistance summary

Figure 3. 11 Temporal variations in resistance of *Escherichia coli* isolates from beef, 2014 to 2018



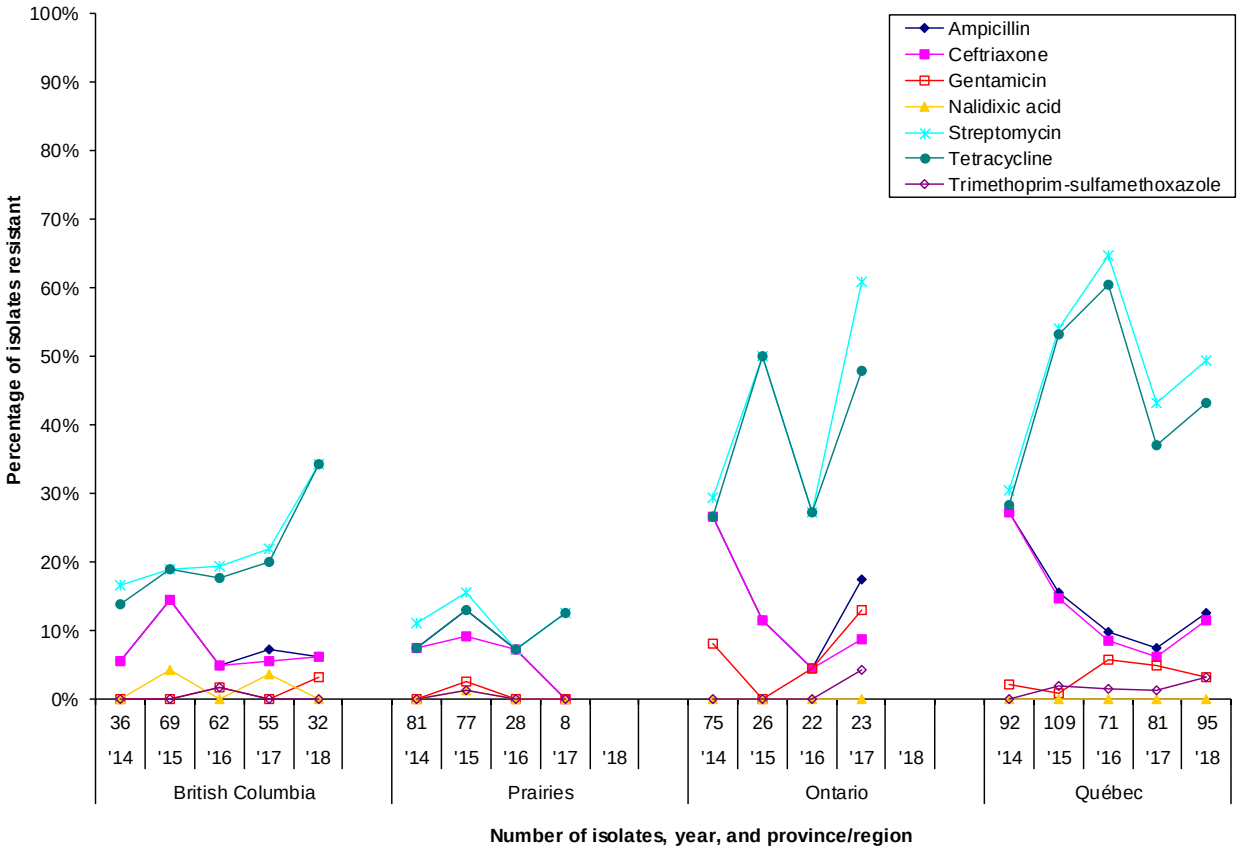
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	43	45	59	59	35	97	86	48	13	7	121	53	68	64	2	85	79	82	82	78
Antimicrobial																				
Ampicillin	**2%**	9%	7%	**2%**	**0%**	**2%**	1%	0%	**0%**	**0%**	**4%**	8%	9%	**13%**	**50%**	**5%**	5%	1%	**7%**	**8%**
Ceftriaxone	**2%**	2%	2%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	1%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
Gentamicin	**0%**	0%	2%	**2%**	**0%**	**1%**	1%	0%	**0%**	**0%**	**1%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**1%**	**1%**
Nalidixic acid	**0%**	2%	2%	**2%**	**3%**	**1%**	2%	0%	**0%**	**0%**	**2%**	2%	1%	**3%**	**0%**	**1%**	1%	0%	**0%**	**3%**
Streptomycin	**2%**	4%	10%	**2%**	**6%**	**9%**	7%	4%	**8%**	**0%**	**12%**	23%	9%	**13%**	**50%**	**11%**	11%	6%	**13%**	**10%**
Tetracycline	**9%**	22%	12%	**5%**	**6%**	**20%**	8%	10%	**15%**	**14%**	**17%**	34%	15%	**30%**	**50%**	**25%**	27%	12%	**17%**	**21%**
Trimethoprim-sulfamethoxazole	**0%**	0%	3%	**2%**	**3%**	**2%**	1%	0%	**0%**	**0%**	**2%**	6%	1%	**2%**	**50%**	**8%**	4%	1%	**2%**	**5%**

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields in this province were not achieved and results should be interpreted with caution. For this reason, data only appear in the table and have been omitted in the figure.

Figure 3. 12 Temporal variations in resistance of *Salmonella* isolates from chicken, 2014 to 2018



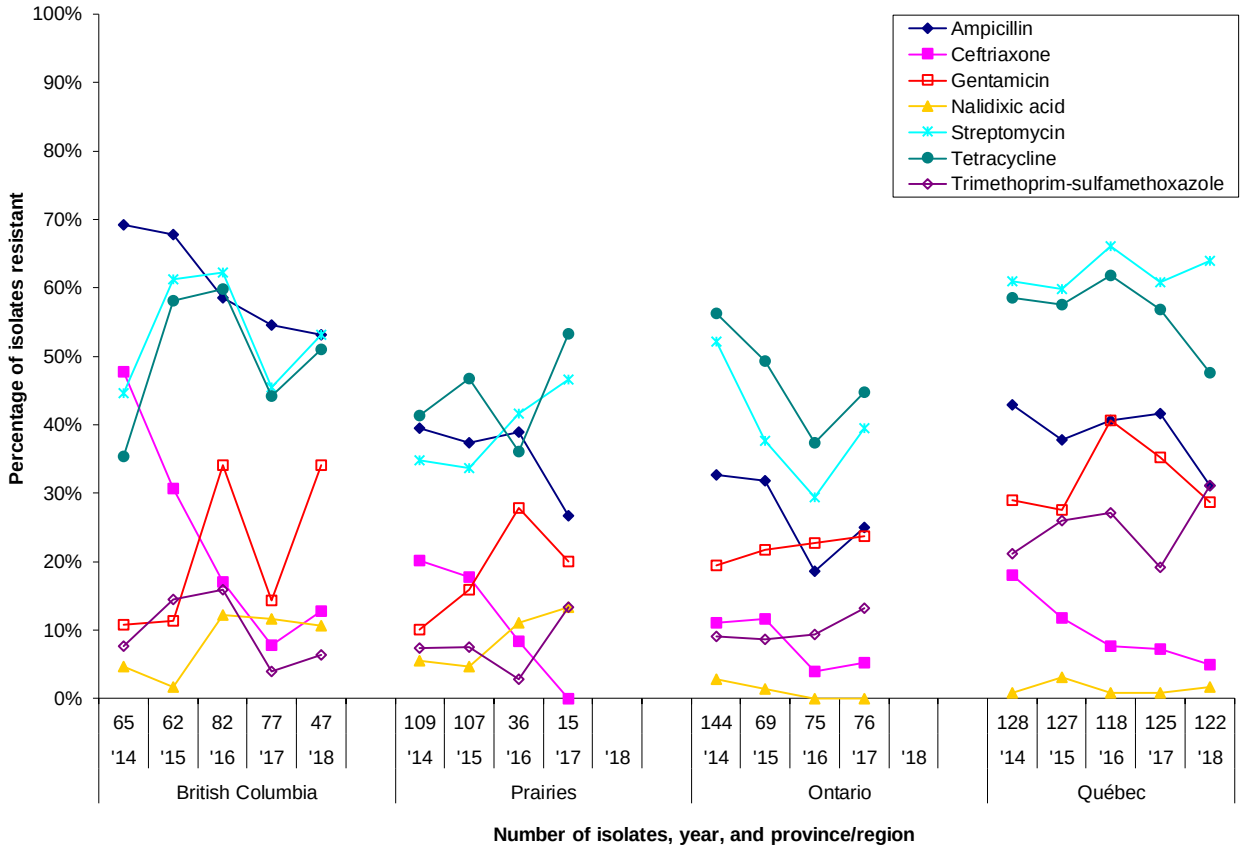
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	36	69	62	55	32	81	77	28	8	3	75	26	22	23	0	92	109	71	81	95
Antimicrobial																				
Ampicillin	**6%**	14%	5%	**7%**	**6%**	**7%**	13%	7%	**0%**	**0%**	**27%**	12%	5%	**17%**		**27%**	16%	10%	**7%**	**13%**
Ceftriaxone	**6%**	14%	5%	**5%**	**6%**	**7%**	9%	7%	**0%**	**0%**	**27%**	12%	5%	**9%**		**27%**	15%	8%	**6%**	**12%**
Gentamicin	**0%**	0%	2%	**0%**	**3%**	**0%**	3%	0%	**0%**	**33%**	**8%**	0%	5%	**13%**		**2%**	1%	6%	**5%**	**3%**
Nalidixic acid	**0%**	4%	0%	**4%**	**0%**	**0%**	1%	0%	**0%**	**33%**	**0%**	0%	0%	**0%**		**0%**	0%	0%	**0%**	**0%**
Streptomycin	**17%**	19%	19%	**22%**	**34%**	**11%**	16%	7%	**13%**	**33%**	**29%**	50%	27%	**61%**		**30%**	54%	65%	**43%**	**49%**
Tetracycline	**14%**	19%	18%	**20%**	**34%**	**7%**	13%	7%	**13%**	**0%**	**27%**	50%	27%	**48%**		**28%**	53%	61%	**37%**	**43%**
Trimethoprim-sulfamethoxazole	**0%**	0%	2%	**0%**	**0%**	**0%**	1%	0%	**0%**	**0%**	**0%**	0%	0%	**4%**		**0%**	2%	1%	**1%**	**3%**

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields in this province were not achieved and results should be interpreted with caution. For this reason, data only appear in the table and have been omitted in the figure.

Figure 3. 13 Temporal variations in resistance of *Escherichia coli* isolates from chicken, 2014 to 2018



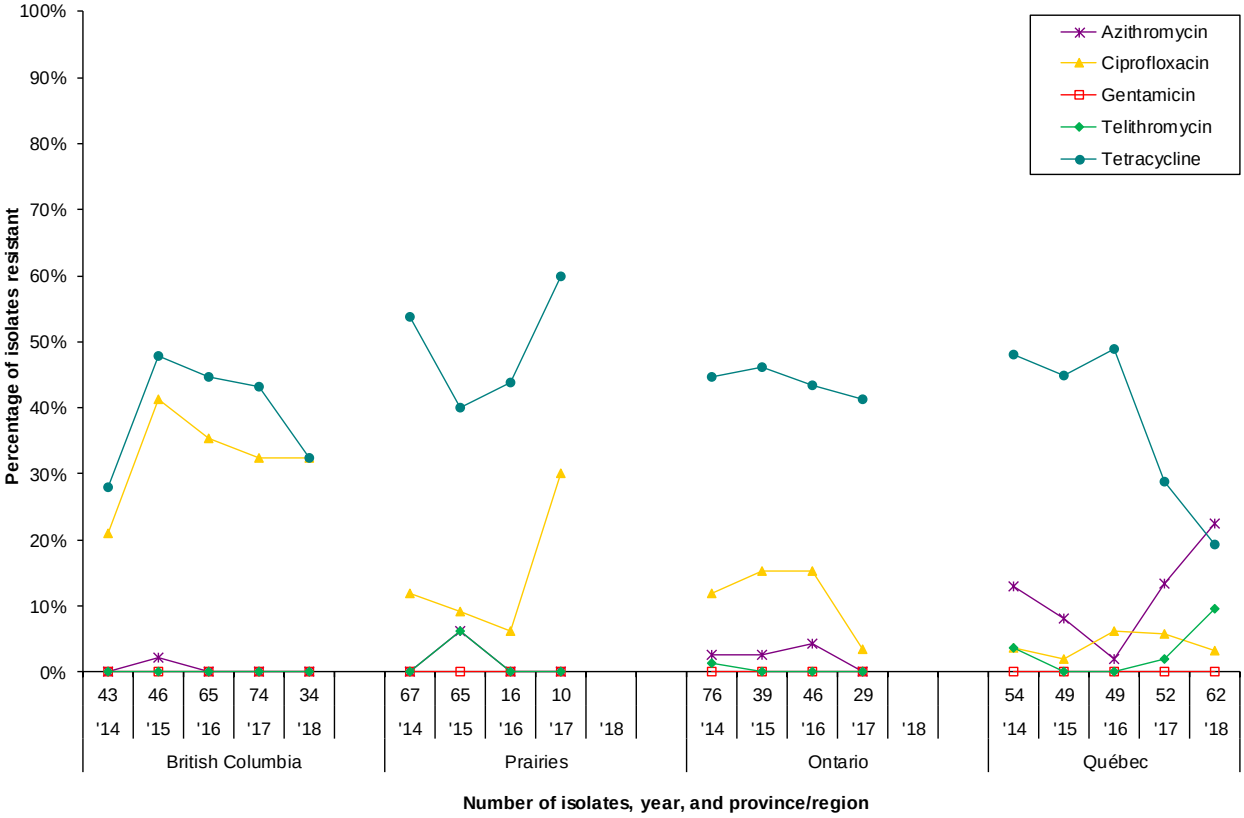
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	65	62	82	77	47	109	107	36	15	9	144	69	75	76	2	128	127	118	125	122
Antimicrobial																				
Ampicillin	**69%**	68%	59%	**55%**	**53%**	**39%**	37%	39%	**27%**	**44%**	**33%**	32%	19%	**25%**	**0%**	**43%**	38%	41%	**42%**	**31%**
Ceftriaxone	**48%**	31%	17%	**8%**	**13%**	**20%**	18%	8%	**0%**	**0%**	**11%**	12%	4%	**5%**	**0%**	**18%**	12%	8%	**7%**	**5%**
Gentamicin	**11%**	11%	34%	**14%**	**34%**	**10%**	16%	28%	**20%**	**33%**	**19%**	22%	23%	**24%**	**100%**	**29%**	28%	41%	**35%**	**29%**
Nalidixic acid	**5%**	2%	12%	**12%**	**11%**	**6%**	5%	11%	**13%**	**11%**	**3%**	1%	0%	**0%**	**0%**	**1%**	3%	1%	**1%**	**2%**
Streptomycin	**45%**	61%	62%	**45%**	**53%**	**35%**	34%	42%	**47%**	**33%**	**52%**	38%	29%	**39%**	**100%**	**61%**	60%	66%	**61%**	**64%**
Tetracycline	**35%**	58%	60%	**44%**	**51%**	**41%**	47%	36%	**53%**	**56%**	**56%**	49%	37%	**45%**	**0%**	**59%**	57%	62%	**57%**	**48%**
Trimethoprim-sulfamethoxazole	**8%**	15%	16%	**4%**	**6%**	**7%**	7%	3%	**13%**	**11%**	**9%**	9%	9%	**13%**	**0%**	**21%**	26%	27%	**19%**	**31%**

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields in this province were not achieved and results should be interpreted with caution. For this reason, data only appear in the table and have been omitted in the figure.

Figure 3. 14 Temporal variations in resistance of *Campylobacter* isolates from chicken, 2014 to 2018



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	43	46	65	74	34	67	65	16	10	6	76	39	46	29	1	54	49	49	52	62
Antimicrobial																				
Azithromycin	**0%**	2%	**0%**	**0%**	**0%**	**0%**	6%	0%	**0%**	**0%**	**3%**	3%	4%	**0%**	**0%**	**13%**	8%	2%	**13%**	**23%**
Ciprofloxacin	**21%**	41%	**35%**	**32%**	**32%**	**12%**	9%	6%	**30%**	**17%**	**12%**	15%	15%	**3%**	**0%**	**4%**	2%	6%	**6%**	**3%**
Gentamicin	**0%**	0%	**0%**	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
Telithromycin	**0%**	0%	**0%**	**0%**	**0%**	**0%**	6%	0%	**0%**	**0%**	**1%**	0%	0%	**0%**	**0%**	**4%**	0%	0%	**2%**	**10%**
Tetracycline	**28%**	48%	**45%**	**43%**	**32%**	**54%**	40%	44%	**60%**	**50%**	**45%**	46%	43%	**41%**	**0%**	**48%**	45%	49%	**29%**	**19%**

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

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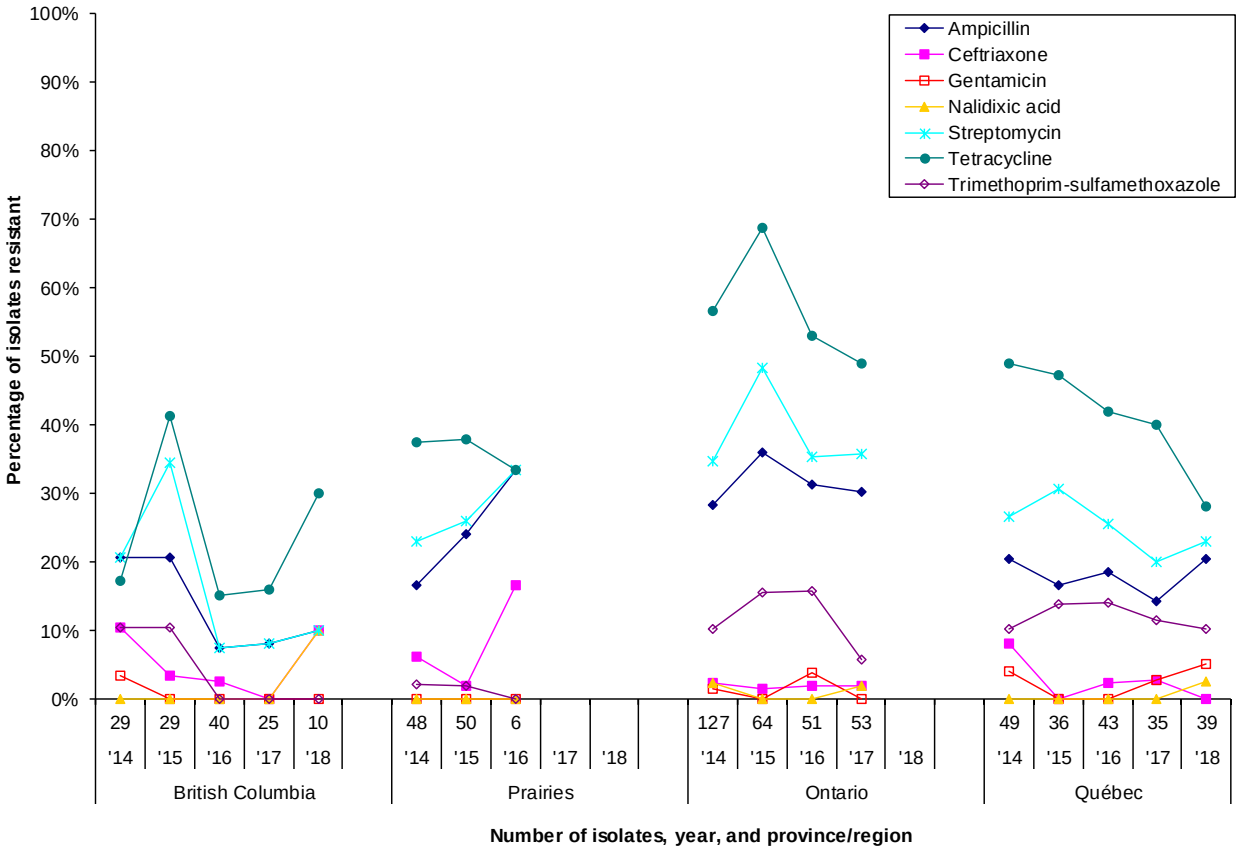
For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields in this province were not achieved and results should be interpreted with caution. For this reason, data only appear in the table and have been omitted in the figure.

Figure 3. 15 Temporal variations in resistance of *Escherichia coli* isolates from pork, 2014 to 2018



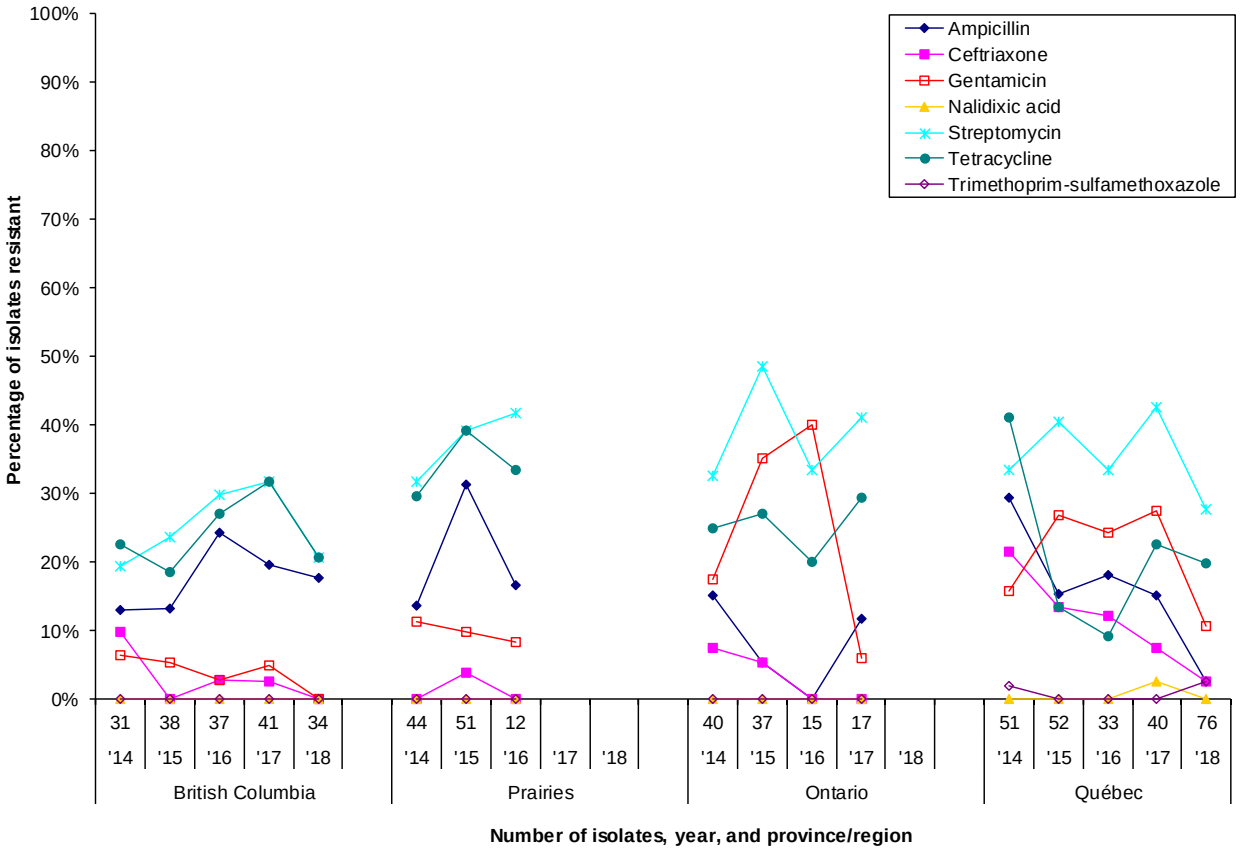
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	29	29	40	25	10	48	50	6	2	1	127	64	51	53	1	49	36	43	35	39
Antimicrobial																				
Ampicillin	**21%**	21%	8%	**8%**	**10%**	**17%**	24%	33%	**0%**	**0%**	**28%**	36%	31%	**30%**	**100%**	**20%**	17%	19%	**14%**	**21%**
Ceftriaxone	**10%**	3%	3%	**0%**	**10%**	**6%**	2%	17%	**0%**	**0%**	**2%**	2%	2%	**2%**	**0%**	**8%**	0%	2%	**3%**	**0%**
Gentamicin	**3%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**2%**	0%	4%	**0%**	**0%**	**4%**	0%	0%	**3%**	**5%**
Nalidixic acid	**0%**	0%	0%	**0%**	**10%**	**0%**	0%	0%	**0%**	**0%**	**2%**	0%	0%	**2%**	**0%**	**0%**	0%	0%	**0%**	**3%**
Streptomycin	**21%**	34%	8%	**8%**	**10%**	**23%**	26%	33%	**0%**	**0%**	**35%**	48%	35%	**36%**	**100%**	**27%**	31%	26%	**20%**	**23%**
Tetracycline	**17%**	41%	15%	**16%**	**30%**	**38%**	38%	33%	**0%**	**0%**	**57%**	69%	53%	**49%**	**100%**	**49%**	47%	42%	**40%**	**28%**
Trimethoprim-sulfamethoxazole	**10%**	10%	0%	**0%**	**0%**	**2%**	2%	0%	**0%**	**0%**	**10%**	16%	16%	**6%**	**0%**	**10%**	14%	14%	**11%**	**10%**

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario in 2018 and the Prairies in 2017 and 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields in this province were not achieved and results should be interpreted with caution. For this reason, data only appear in the table and have been omitted in the figure.

Figure 3. 16 Temporal variations in resistance of *Salmonella* isolates from turkey, 2014 to 2018



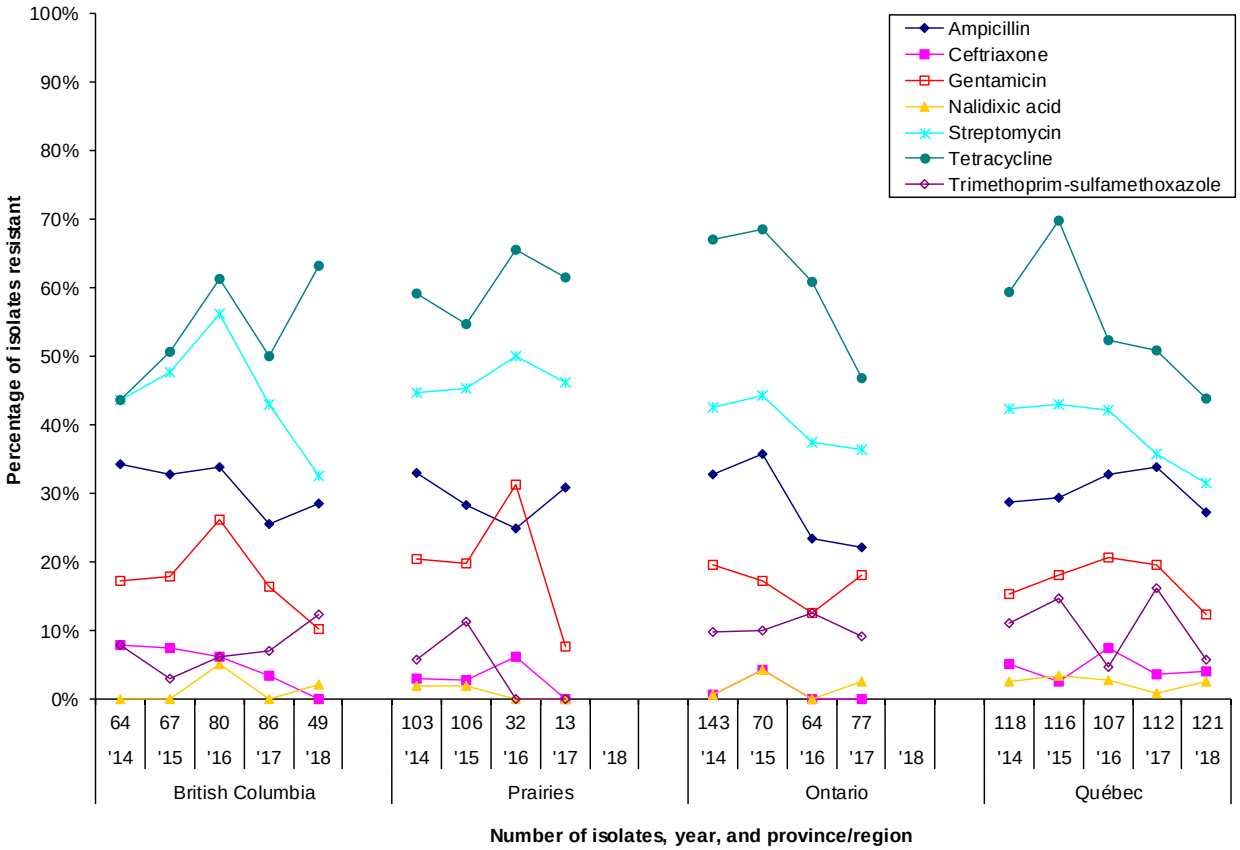
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	31	38	37	41	34	44	51	12	3	3	40	37	15	17	0	51	52	33	40	76
Antimicrobial																				
Ampicillin	**13%**	13%	24%	**20%**	**18%**	**14%**	31%	17%	**0%**	**67%**	**15%**	5%	0%	**12%**		**29%**	15%	18%	**15%**	**3%**
Ceftriaxone	**10%**	0%	3%	**2%**	**0%**	**0%**	4%	0%	**0%**	**0%**	**8%**	5%	0%	**0%**		**22%**	13%	12%	**8%**	**3%**
Gentamicin	**6%**	5%	3%	**5%**	**0%**	**11%**	10%	8%	**0%**	**0%**	**18%**	35%	40%	**6%**		**16%**	27%	24%	**28%**	**11%**
Nalidixic acid	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**		**0%**	0%	0%	**3%**	**0%**
Streptomycin	**19%**	24%	30%	**32%**	**21%**	**32%**	39%	42%	**0%**	**33%**	**33%**	49%	33%	**41%**		**33%**	40%	33%	**43%**	**28%**
Tetracycline	**23%**	18%	27%	**32%**	**21%**	**30%**	39%	33%	**0%**	**33%**	**25%**	27%	20%	**29%**		**41%**	13%	9%	**23%**	**20%**
Trimethoprim-sulfamethoxazole	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**		**2%**	0%	0%	**0%**	**3%**

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario in 2018 and the Prairies in 2017 and 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields in this province were not achieved and results should be interpreted with caution. For this reason, data only appear in the table and have been omitted in the figure.

Figure 3. 17 Temporal variations in resistance of *Escherichia coli* isolates from turkey, 2014 to 2018



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	64	67	80	86	49	103	106	32	13	7	143	70	64	77	2	118	116	107	112	121
Antimicrobial																				
Ampicillin	**34%**	33%	34%	**26%**	**29%**	**33%**	28%	25%	**31%**	**29%**	**33%**	36%	23%	**22%**	**0%**	**29%**	29%	33%	**34%**	**27%**
Ceftriaxone	**8%**	7%	6%	**3%**	**0%**	**3%**	3%	6%	**0%**	**0%**	**1%**	4%	0%	**0%**	**0%**	**5%**	3%	7%	**4%**	**4%**
Gentamicin	**17%**	18%	26%	**16%**	**10%**	**20%**	20%	31%	**8%**	**14%**	**20%**	17%	13%	**18%**	**0%**	**15%**	18%	21%	**20%**	**12%**
Nalidixic acid	**0%**	0%	5%	**0%**	**2%**	**2%**	2%	0%	**0%**	**0%**	**1%**	4%	0%	**3%**	**0%**	**3%**	3%	3%	**1%**	**2%**
Streptomycin	**44%**	48%	56%	**43%**	**33%**	**45%**	45%	50%	**46%**	**29%**	**43%**	44%	38%	**36%**	**50%**	**42%**	43%	42%	**36%**	**31%**
Tetracycline	**44%**	51%	61%	**50%**	**63%**	**59%**	55%	66%	**62%**	**71%**	**67%**	69%	61%	**47%**	**50%**	**59%**	70%	52%	**51%**	**44%**
Trimethoprim-sulfamethoxazole	**8%**	3%	6%	**7%**	**12%**	**6%**	11%	0%	**0%**	**0%**	**10%**	10%	13%	**9%**	**0%**	**11%**	15%	5%	**16%**	**6%**

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields in this province were not achieved and results should be interpreted with caution. For this reason, data only appear in the table and have been omitted in the figure.

Recovery results

Table 3. 9 Retail Meat Surveillance recovery rates, 2003 to 2018

CIPARS Component / Animal species	Province / region	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted					
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*	
Beef	British Columbia	2005	**93%**	27/29						
		2007	**79%**	49/62						
		2008	**77%**	88/115						
		2009	**71%**	79/112						
		2010	**51%**	64/125						
		2011	**53%**	57/107						
		2012	**60%**	76/126						
		2013	**47%**	40/85						
		2014	**43%**	43/100						
		2015	**42%**	45/108						
		2016	**45%**	59/130						
		2017	**44%**	59/135						
		2018	**47%**	35/75						
	Prairies	2005	**79%**	120/151						
		2006	**76%**	123/161						
		2007	**78%**	118/151						
		2008	**76%**	134/177						
		2009	**83%**	135/163						
		2010	**80%**	107/134						
		2011[a]	**75%**	54/72						
		2012	**75%**	80/107						
		2013	**53%**	48/90						
		2014	**53%**	97/184						
		2015	**46%**	86/186						
		2016	**62%**	48/78						
		2017	**42%**	13/31						
		2018	**35%**	7/20						
	Ontario	2003	**66%**	101/154	**2%**	2/84	**3%**	2/76	**91%**	69/76
		2004	**80%**	190/237						
		2005	**81%**	184/227						
		2006	**81%**	189/235						
		2007	**71%**	184/227						
		2008	**78%**	185/236						
		2009	**79%**	195/248						
		2010	**69%**	123/177						
		2011	**73%**	161/222						
		2012	**63%**	110/176						
		2013	**58%**	104/180						
		2014	**51%**	121/236						
		2015	**46%**	53/116						
		2016	**56%**	68/122						
		2017	**51%**	64/126						
		2018	**50%**	2/4						
	Québec	2003	**57%**	84/147	**0%**	0/33	**0%**	0/33	**80%**	28/35
		2004	**56%**	137/245						
		2005	**56%**	126/225						
		2006	**50%**	109/215						
		2007	**68%**	147/216						
		2008	**59%**	126/214						
		2009	**54%**	108/201						
		2010	**46%**	102/223						
		2011	**45%**	91/204						
		2012	**51%**	107/219						
		2013	**42%**	74/175						
		2014	**41%**	85/207						
		2015	**39%**	79/203						
		2016	**43%**	82/192						
		2017	**39%**	82/210						
		2018	**36%**	78/214						

See corresponding footnotes at the end of the table.

Table 3. 9 Retail Meat Surveillance recovery rates, 2003 to 2018 (continued)

CIPARS Component / Animal species	Province / region	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted							
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*	
	Atlantic	2004	**67%**	16/24						
		2007	**52%**	16/31						
		2008	**70%**	39/56						
		2009	**69%**	137/200						
		2010	**69%**	126/183						
		2011	**58%**	110/191						
		2012[d]	**50%**	24/48						
		2013	**58%**	83/143						
		2014	**57%**	118/207						
		2015[e]								
		2016[e]								
		2017[e]								
		2018[e]								
Chicken	British Columbia	2005	**95%**	19/20	**13%**	5/39	**69%**	27/39	**100%**	20/20
		2007	**98%**	42/43	**22%**[b]	18/81	**35%**	28/80	**100%**	34/34
		2008	**90%**	70/78	**32%**	47/145	**34%**	50/145	**100%**	78/78
		2009	**95%**	70/74	**40%**	59/146	**53%**	78/146	**97%**	72/74
		2010	**89%**	75/84	**34%**	56/166	**42%**	70/166		
		2011	**96%**	70/73	**45%**	64/143	**50%**	71/143		
		2012	**99%**	82/83	**32%**	53/166	**44%**	73/166		
		2013	**95%**	57/60	**24%**	28/118	**42%**	50/118		
		2014	**98%**	65/66	**27%**	36/133	**32%**	43/133		
		2015	**91%**	62/68	**51%**	69/136	**35%**	47/136		
		2016	**94%**	82/87	**36%**	62/173	**38%**	65/172		
		2017	**89%**	77/87	**32%**	55/173	**43%**	74/173		
		2018	**94%**	47/50	**33%**	32/97	**35%**	34/97		
	Prairies	2005	**98%**	81/83	**14%**	21/153	**37%**	53/145	**98%**	83/85
		2006	**98%**	85/86	**16%**	25/153	**33%**	51/155	**98%**	85/87
		2007	**97%**	75/77	**31%**[b]	43/141	**35%**	49/141	**100%**	77/77
		2008	**99%**	91/92	**40%**	64/161	**25%**	41/161	**100%**	92/92
		2009	**98%**	90/92	**47%**	71/150	**32%**	48/150	**100%**	92/92
		2010	**90%**	71/79	**32%**	42/132	**28%**	37/132		
		2011[a]	**97%**	38/39	**40%**	29/73	**34%**	25/73		
		2012	**94%**	67/71	**33%**	46/140	**29%**	40/140		
		2013	**97%**	58/60	**32%**	38/120	**20%**	24/120		
		2014	**97%**	109/112	**36%**	81/222	**30%**	67/222		
		2015	**95%**	107/113	**35%**	77/220	**30%**	65/220		
		2016	**90%**	36/40	**37%**	28/76	**21%**	16/76		
		2017	**94%**	15/16	**24%**	8/33	**30%**	10/33		
		2018	**90%**	9/10	**15%**	3/20	**30%**	6/20		
	Ontario	2003	**95%**	137/144	**16%**	27/167	**47%**	78/166	**99%**	143/144
		2004	**95%**	150/158	**17%**	54/315	**45%**	143/315	**100%**	158/158
		2005	**95%**	145/153	**9%**	26/303	**40%**	120/303	**99%**	150/152
		2006	**97%**	152/156	**12%**	36/311	**34%**	104/311	**98%**	154/156
		2007	**98%**	157/161	**54%**[b]	172/320	**37%**	117/320	**100%**	161/161
		2008	**96%**	150/156	**45%**	139/311	**39%**	121/311	**99%**	154/156
		2009	**95%**	155/164	**43%**	142/328	**31%**	101/328	**100%**	164/164
		2010	**86%**	100/116	**39%**	90/232	**28%**	64/232		
		2011	**93%**	137/147	**40%**	119/294	**24%**	71/293		
		2012	**92%**	107/116	**44%**	102/232	**39%**	87/226		
		2013	**93%**	110/118	**39%**	89/231	**35%**	83/234		
		2014	**92%**	144/157	**24%**	75/312	**25%**	78/312		
		2015	**91%**	69/76	**17%**	26/151	**26%**	40/151		
		2016	**93%**	75/81	**14%**	22/160	**29%**	46/160		
		2017	**93%**	76/82	**14%**	23/164	**18%**	29/164		
		2018	**100%**	2/2	**0%**	0/4	**25%**	1/4		

See corresponding footnotes at the end of the table.

Table 3. 9 Retail Meat Surveillance recovery rates, 2003 to 2018 (continued)

CIPARS Component / Animal species	Province / region	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted							
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*	
	Québec	2003	**89%**	112/126	**16%**	29/171	**55%**	94/170	**100%**	125/125
		2004	**96%**	157/161	**17%**	53/320	**50%**	161/322	**100%**	161/161
		2005	**95%**	142/149	**9%**	26/300	**34%**	103/299	**100%**	150/150
		2006	**94%**	135/144	**12%**	33/288	**35%**	100/288	**100%**	144/144
		2007	**90%**	129/144	**40%**[b]	113/287	**21%**	59/287	**99%**	143/144
		2008	**91%**	131/144	**42%**	120/287	**19%**	54/287	**100%**	144/144
		2009	**94%**	126/134	**39%**	105/267	**20%**	52/266	**99%**	132/134
		2010	**93%**	138/148	**39%**	116/296	**21%**	63/296		
		2011	**99%**	134/136	**37%**	100/272	**21%**	57/272		
		2012	**95%**	133/140	**38%**	106/280	**28%**	78/274		
		2013	**90%**	105/117	**37%**	89/243	**23%**	55/243		
		2014	**93%**	129/138	**33%**	92/276	**20%**	54/276		
		2015	**93%**	127/136	**40%**	109/272	**18%**	49/272		
		2016	**92%**	118/128	**28%**	71/256	**19%**	49/254		
		2017	**89%**	125/140	**29%**	81/281	**19%**	52/281		
		2018	**86%**	122/142	**33%**	95/285	**22%**	62/285		
	Atlantic	2004	**100%**	13/13	**4%**	1/25	**40%**	10/25	**100%**	13/13
		2007[c]	**91%**	29/32	**22%**[b]	7/32				
		2008[c]	**68%**	38/56	**22%**	12/56				
		2009[c]	**94%**	187/199	**49%**	97/199	**29%**	57/199		
		2010	**93%**	176/190	**41%**	77/190	**37%**	70/190		
		2011	**89%**	171/192	**28%**	53/192	**30%**	57/192		
		2012[d]	**96%**	46/48	**23%**	11/48	**21%**	10/48		
		2013	**92%**	133/144	**31%**	44/144	**47%**	67/144		
		2014	**86%**	179/207	**31%**	64/207	**25%**	52/206		
		2015[e]								
		2016[e]								
		2017[e]								
		2018[e]								
Pork	British Columbia	2005	**31%**	10/32						
		2007	**29%**	23/79	**1%**	1/79				
		2008	**30%**	44/148	**2%**	3/148				
		2009	**26%**	38/145	**1%**	2/145				
		2010	**19%**	31/166	**1%**	2/167				
		2011	**27%**	49/180	**2%**	3/180				
		2012	**25%**	41/167	**0%**	0/167				
		2013	**28%**	33/118	**0%**	0/118				
		2014	**22%**	29/131	**2%**	2/132				
		2015	**21%**	29/136						
		2016	**23%**	40/172						
		2017	**15%**	25/172						
		2018	**10%**	10/98						
	Prairies	2005	**30%**	48/162						
		2006	**30%**	49/165	**2%**	3/134				
		2007	**25%**	38/154	**2%**	3/154				
		2008	**23%**	41/176	**1%**	1/176				
		2009	**18%**	29/164	**0%**	0/164				
		2010	**12%**	17/142	**1%**	1/142				
		2011[a]	**11%**	10/90	**1%**	1/90				
		2012	**19%**	26/140	**1%**	2/141				
		2013	**24%**	28/119	**3%**	3/120				
		2014	**22%**	48/223	**1%**	3/223				
		2015	**23%**	50/220						
		2016	**8%**	6/78						
		2017	**6%**	2/31						
		2018	**5%**	1/20						

See corresponding footnotes at the end of the table.

Table 3. 9 Retail Meat Surveillance recovery rates, 2003 to 2018 (continued)

CIPARS Component / Animal species	Province / region	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted							
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*	
	Ontario	2003	**58%**	90/154	**1%**	1/93	**0%**	0/76	**87%**	66/76
		2004	**71%**	198/279						
		2005	**59%**	179/303						
		2006	**59%**	182/311	**< 1%**	1/255				
		2007	**54%**	172/320	**2%**	6/319				
		2008	**50%**	155/312	**2%**	7/310				
		2009	**41%**	136/328	**2%**	8/327				
		2010	**38%**	84/224	**0%**	0/224				
		2011	**42%**	155/371	**2%**	6/370				
		2012	**37%**	86/231	**2%**	5/231				
		2013	**43%**	100/233	**1%**	3/232				
		2014	**41%**	127/312	**2%**	6/312				
		2015	**42%**	64/152						
		2016	**32%**	51/160						
		2017	**32%**	53/164						
		2018	**25%**	1/4						
	Québec	2003	**42%**	61/147	**3%**	1/32	**9%**	3/32	**82%**	28/34
		2004	**38%**	109/290						
		2005	**26%**	79/300						
		2006	**20%**	57/287	**0%**	0/232				
		2007	**22%**	64/287	**1%**	3/288				
		2008	**21%**	60/287	**2%**	5/286				
		2009	**15%**	41/268	**1%**	3/268				
		2010	**16%**	47/296	**1%**	4/296				
		2011	**32%**	122/387	**4%**	17/387				
		2012	**16%**	46/279	**3%**	8/279				
		2013	**20%**	48/239	**<1%**	1/239				
		2014	**18%**	49/276	**<1%**	2/276				
		2015	**13%**	36/272						
		2016	**17%**	43/256						
		2017	**13%**	35/280						
		2018	**14%**	39/284						
	Atlantic	2004	**58%**	14/24						
		2007	**39%**	13/31	**3%**	1/30				
		2008	**30%**	17/56	**2%**	1/56				
		2009	**41%**	82/200	**3%**	5/199				
		2010	**39%**	74/190	**4%**	8/190				
		2011	**43%**	95/223	**3%**	7/221				
		2012[d]	**25%**	12/48	**0%**	0/48				
		2013	**40%**	57/143	**1%**	2/142				
		2014	**41%**	86/209	**6%**	13/208				
		2015[e]								
		2016[e]								
		2017[e]								
		2018[e]								

See corresponding footnotes at the end of the table.

Table 3. 9 Retail Meat Surveillance recovery rates, 2003 to 2018 (continued)

CIPARS Component / Animal species	Province / region	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted							
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*	
Turkey	British Columbia	2011	**97%**	59/61	**11%**	8/71	**24%**	17/71		
		2012	**97%**	101/104	**18%**	27/153	**22%**	33/153		
		2013	**98%**	59/60	**26%**	30/115	**22%**	25/115		
		2014	**97%**	64/66	**25%**	31/122	**23%**	28/122		
		2015	**99%**	67/68	**32%**	38/118	**20%**	24/118		
		2016	**94%**	80/85	**24%**	36/152	**7%**	10/153		
		2017	**99%**	86/87	**30%**	41/139	**13%**	9/72		
		2018	**96%**	49/51	**37%**	34/91				
	Prairies	2011[a]	**100%**	10/10	**20%**	2/10	**10%**	1/10		
		2012	**91%**	81/89	**14%**	18/128	**5%**	6/128		
		2013	**90%**	56/62	**23%**	25/107	**4%**	4/105		
		2014	**93%**	103/111	**22%**	44/196	**7%**	13/196		
		2015	**99%**	106/107	**31%**	51/165	**7%**	11/165		
		2016	**97%**	32/33	**29%**	12/41	**7%**	3/41		
		2017	**100%**	13/13	**18%**	3/17	**8%**	1/13		
		2018	**88%**	7/8	**25%**	3/12				
	Ontario	2011	**95%**	162/171	**14%**	27/191	**9%**	18/191		
		2012	**97%**	152/156	**20%**	44/223	**9%**	20/223		
		2013	**95%**	115/121	**12%**	28/228	**12%**	27/227		
		2014	**92%**	143/156	**13%**	40/310	**9%**	28/310		
		2015	**92%**	70/76	**24%**	37/152	**5%**	8/152		
		2016	**81%**	64/79	**9%**	15/158	**4%**	6/158		
		2017	**94%**	77/82	**11%**	17/161	**6%**	5/88		
		2018	**100%**	2/2	**0%**	0/4				
	Québec	2011	**91%**	138/152	**17%**	27/163	**10%**	16/163		
		2012	**96%**	170/178	**21%**	51/246	**6%**	15/246		
		2013	**89%**	98/110	**32%**	57/177	**9%**	16/178		
		2014	**86%**	119/138	**19%**	51/262	**2%**	5/262		
		2015	**86%**	116/135	**21%**	52/247	**4%**	9/247		
		2016	**84%**	107/128	**14%**	33/238	**3%**	6/237		
		2017	**80%**	112/140	**16%**	40/247	**5%**	5/105		
		2018	**85%**	121/142	**28%**	77/271				
	Atlantic	2013	**85%**	107/126	**19%**	24/126	**23%**	29/124		
		2014	**76%**	143/187	**12%**	23/187	**8%**	15/185		
		2015[e]								
		2016[e]								
		2017[e]								
		2018[e]								

See corresponding footnotes at the end of the table.

Table 3. 9 Retail Meat Surveillance recovery rates, 2003 to 2018 (continued)

Grey-shaded areas indicate either: a) isolates recovered from sampling activities outside the scope of CIPARS routine (or "core") surveillance in the specified year (i.e. grey-shaded areas with data) or b) discontinuation or no surveillance activity (i.e. grey-shaded areas with no data).

The Prairies is a region including the provinces Alberta and Saskatchewan.

For Ontario and the Prairies in 2018, a partial year of retail sampling was conducted due to difficulties in staffing field personnel. As a result, the sampling target and subsequent isolate yields in this province were not achieved and results should be interpreted with caution.

The Atlantic region includes New Brunswick, Nova Scotia, and Prince Edward Island.

[a] In 2011, due to an unforeseeable pause in retail sampling in Saskatchewan of approximately 3 months, the expected number of samples was not met and thus, results for the Prairies for this year should be interpreted with caution.

[b] Enhancement to the *Salmonella* recovery method yielded higher recovery rates from retail chicken in 2007 than in prior years.

[c] For the Atlantic region, recovery results are not presented for *Campylobacter* in 2007 and 2008 as well as for Enterococcus in 2007, 2008, and 2009 due to concerns regarding harmonization of laboratory methods.

[d] Due to an unforeseeable pause in retail sampling in the Atlantic region from April through December in 2012, the expected number of samples was not achieved and thus, results for this region in 2012 are not representative and potentially lack the precision necessary to be included as regular surveillance data. For this reason, these data are not presented anywhere else in this chapter.

[e] No retail sampling was conducted in the Atlantic region in 2015 to 2018.

Abattoir Surveillance

Multiclass resistance

Table 3. 10 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from beef cattle, 2018

Animal species	Number of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Beef cattle	125	77	26	16	6			21	5			1		17	1		7		1	43

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Table 3. 11 Number of antimicrobial classes in resistance patterns of *Campylobacter* from beef cattle, 2018

Species	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial										
							Aminoglycosides	Ketolides	Lincosamides	Macrolides		Phenicols	Quinolones		Tetracyclines		
		0	1	2–3	4–5	6–7	GEN	TEL	CLI	AZM	ERY	FLR	CIP	NAL	TET		
Campylobacter jejuni	77 (71.3)	23	40	14									15	15	53		
Campylobacter coli	28 (25.9)	12	11	2	3			4	4	4	4		4	4	12		
Campylobacter spp.	3 (2.8)			3										3	3		
Total	**108 (100)**	**35**	**51**	**19**	**3**			**4**	**4**	**4**	**4**		**19**	**22**	**68**		

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Campylobacter spp. include unidentified species, some of which may be intrinsically resistant to nalidixic acid.

Table 3. 12 Number of antimicrobial classes in resistance patterns of *Salmonella* from chickens, 2018

Serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial												
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Kentucky	45 (38.1)	1	2	41	1		1	42	9	8	8	7							1	42
Enteritidis	32 (27.1)	30	2																2	
Heidelberg	9 (7.6)	4	4	1				1	3	2	2	2		2	2					
Livingstone	6 (5.1)		5	1				1												6
Infantis	5 (4.2)	5																		
Typhimurium	5 (4.2)			5										5						5
Less common serovars	16 (13.6)	13		3				3												3
Total	**118 (100)**	**53**	**13**	**51**	**1**		**1**	**47**	**12**	**10**	**10**	**9**		**7**	**2**				**3**	**56**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

Table 3. 13 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from chickens, 2018

Animal species	Number of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial												
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Chickens	227	62	31	98	35	1	60	129	69	13	15	13		106	44	1	11	3	20	89

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Table 3. 14 Number of antimicrobial classes in resistance patterns of *Campylobacter* from chickens, 2018

Species	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial							
							Aminoglycosides	Ketolides	Lincosamides	Macrolides		Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	TEL	CLI	AZM	ERY	FLR	CIP	NAL	TET
Campylobacter jejuni	171 (80.3)	92	48	31				4	2	5	5		34	34	69
Campylobacter coli	29 (13.6)	17	3	5	4			4	4	4	4		7	7	10
Campylobacter spp.	13 (6.1)	7	6										1	1	5
Total	**213 (100)**	**116**	**57**	**36**	**4**			**8**	**6**	**9**	**9**		**42**	**42**	**84**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Campylobacter spp. include unidentified species, some of which may be intrinsically resistant to nalidixic acid.

Table 3. 15 Number of antimicrobial classes in resistance patterns of *Salmonella* from pigs, 2018

Serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial												
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Derby	40 (21.7)	17	7	9	7			17	8	2	2	2		16						21
Infantis	15 (8.2)	12		2	1			2	1	1	1	1		1	1	1	1			3
Typhimurium	15 (8.2)	3	1	4	7		1	9	9	1	1	1		10	3		6			9
Brandenburg	13 (7.1)	7	5	1				1	2											4
4,[5],12:i:-	13 (7.1)		1		12		1	12	12					12	3	2	1			13
London	11 (6.0)	8	2		1		1	1	3	2	2	2		1						1
Schwarzengrund	11 (6.0)	10		1				1						1						1
Bovismorbificans	9 (4.9)	8			1			1	1					1						1
Mbandaka	8 (4.3)	4		4			3	4						4	1					3
Uganda	7 (3.8)	7																		
Agona	5 (2.7)	4		1				1						1						1
Give	4 (2.2)	3		1										1	1					1
Worthington	4 (2.2)	2		1	1			2	1					2	2		2			1
Less common serovars	29 (15.8)	14	5	6	4		1	9	4					7	3		4			13
Total	**184 (100)**	**99**	**21**	**30**	**34**		**7**	**60**	**41**	**6**	**6**	**6**		**57**	**14**	**3**	**14**			**72**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

Table 3. 16 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from pigs, 2018

Animal species	Number of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Pigs	157	42	41	56	18		1	61	51	5	4	6		42	12	2	18		1	87

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Table 3. 17 Number of antimicrobial classes in resistance patterns of *Campylobacter* from pigs, 2018

Species	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial							
							Aminoglycosides	Ketolides	Lincosamides	Macrolides		Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	TEL	CLI	AZM	ERY	FLR	CIP	NAL	TET
Campylobacter coli	231 (98.3)	71	72	43	45			63	67	71	71		24	24	138
Campylobacter spp.	4 (1.7)	1	2	1										1	3
Total	**235 (100)**	**72**	**74**	**44**	**45**			**63**	**67**	**71**	**71**		**24**	**25**	**141**

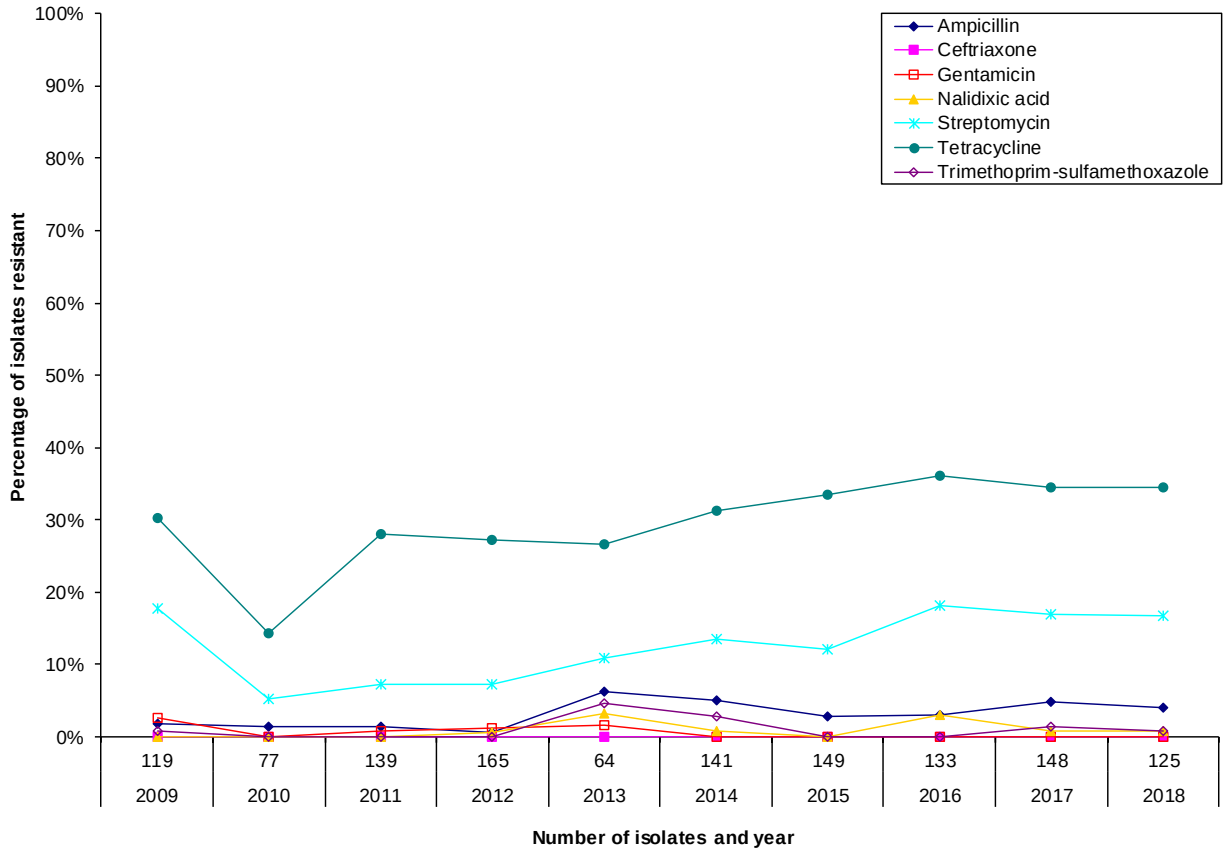
Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Campylobacter spp. include unidentified species, some of which may be intrinsically resistant to nalidixic acid.

Temporal antimicrobial resistance summary

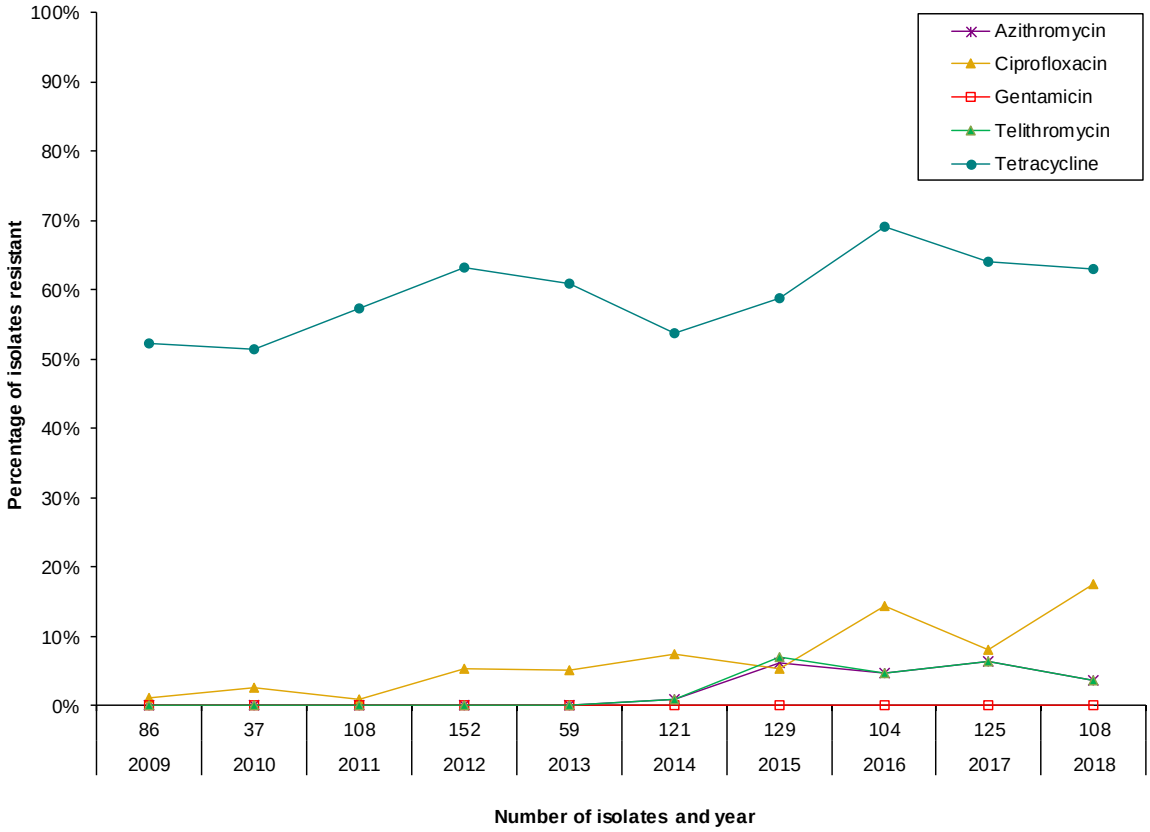
Figure 3. 18 Temporal variations in resistance of *Escherichia coli* isolates from beef cattle, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	119	77	139	165	64	141	149	133	148	125
Antimicrobial										
Ampicillin	2%	1%	1%	1%	6%	5%	3%	3%	5%	4%
Ceftriaxone	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Gentamicin	3%	0%	1%	1%	2%	0%	0%	0%	0%	0%
Nalidixic acid	0%	0%	0%	1%	3%	1%	0%	3%	1%	1%
Streptomycin	18%	5%	7%	7%	11%	13%	12%	18%	17%	17%
Tetracycline	30%	14%	28%	27%	27%	31%	34%	36%	34%	34%
Trimethoprim-sulfamethoxazole	1%	0%	0%	0%	5%	3%	0%	0%	1%	1%

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years, 5 years, and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

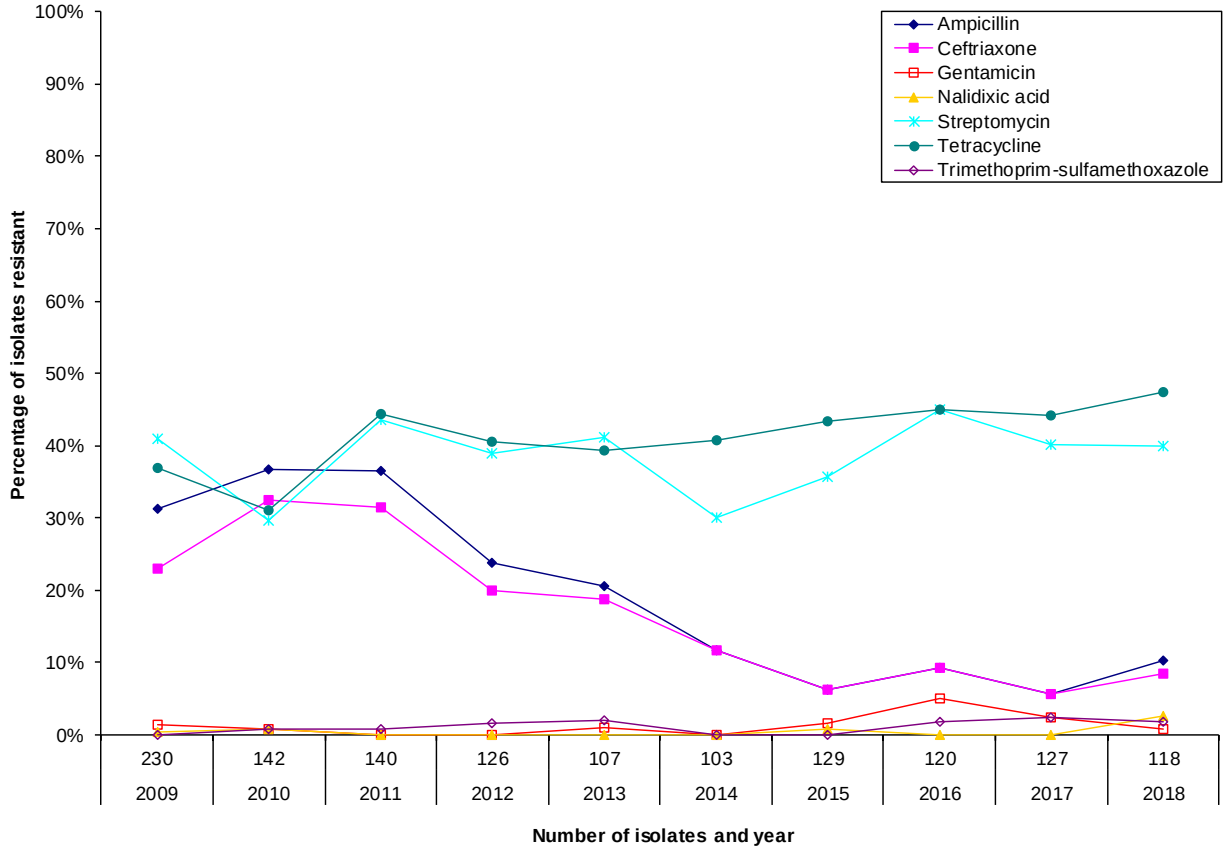
Figure 3. 19 Temporal variations in resistance of *Campylobacter* from beef cattle, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	86	37	108	152	59	121	129	104	125	108
Antimicrobial										
Azithromycin	**0%**	0%	0%	0%	0%	**1%**	6%	5%	**6%**	**4%**
Ciprofloxacin	**1%**	3%	1%	5%	5%	**7%**	5%	14%	**8%**	**18%**
Gentamicin	**0%**	0%	0%	0%	0%	**0%**	0%	0%	**0%**	**0%**
Telithromycin	**0%**	0%	0%	0%	0%	**1%**	7%	5%	**6%**	**4%**
Tetracycline	**52%**	51%	57%	63%	61%	**54%**	59%	69%	**64%**	**63%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years, 5 years, and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

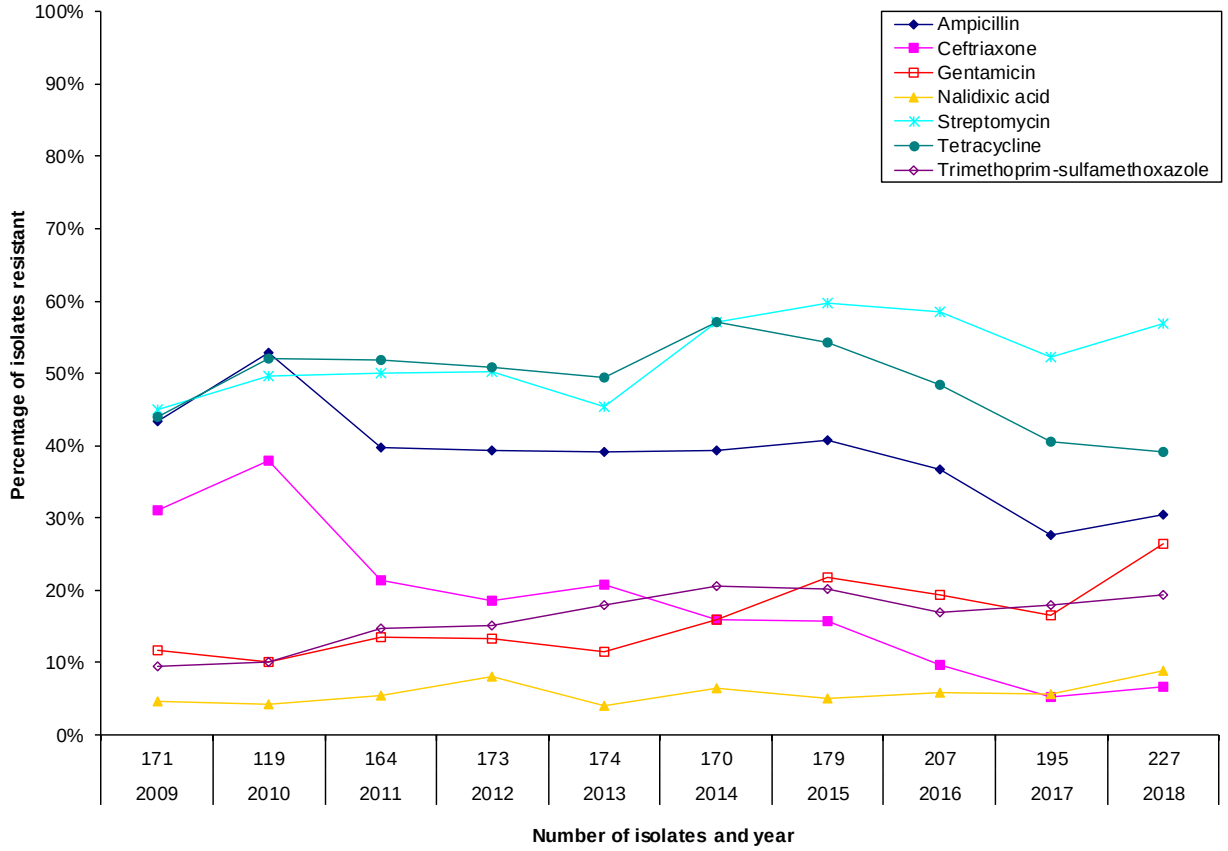
Figure 3. 20 Temporal variations in resistance of *Salmonella* isolates from chicken, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	230	142	140	126	107	103	129	120	127	118
Antimicrobial										
Ampicillin	**31%**	37%	36%	24%	21%	**12%**	6%	9%	**6%**	**10%**
Ceftriaxone	**23%**	32%	31%	20%	19%	**12%**	6%	9%	**6%**	**8%**
Gentamicin	**1%**	1%	0%	0%	1%	**0%**	2%	5%	**2%**	**1%**
Nalidixic acid	**0%**	1%	0%	0%	0%	**0%**	1%	0%	**0%**	**3%**
Streptomycin	**41%**	30%	44%	39%	41%	**30%**	36%	45%	**40%**	**40%**
Tetracycline	**37%**	31%	44%	40%	39%	**41%**	43%	45%	**44%**	**47%**
Trimethoprim-sulfamethoxazole	**0%**	1%	1%	2%	2%	**0%**	0%	2%	**2%**	**2%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years, 5 years, and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

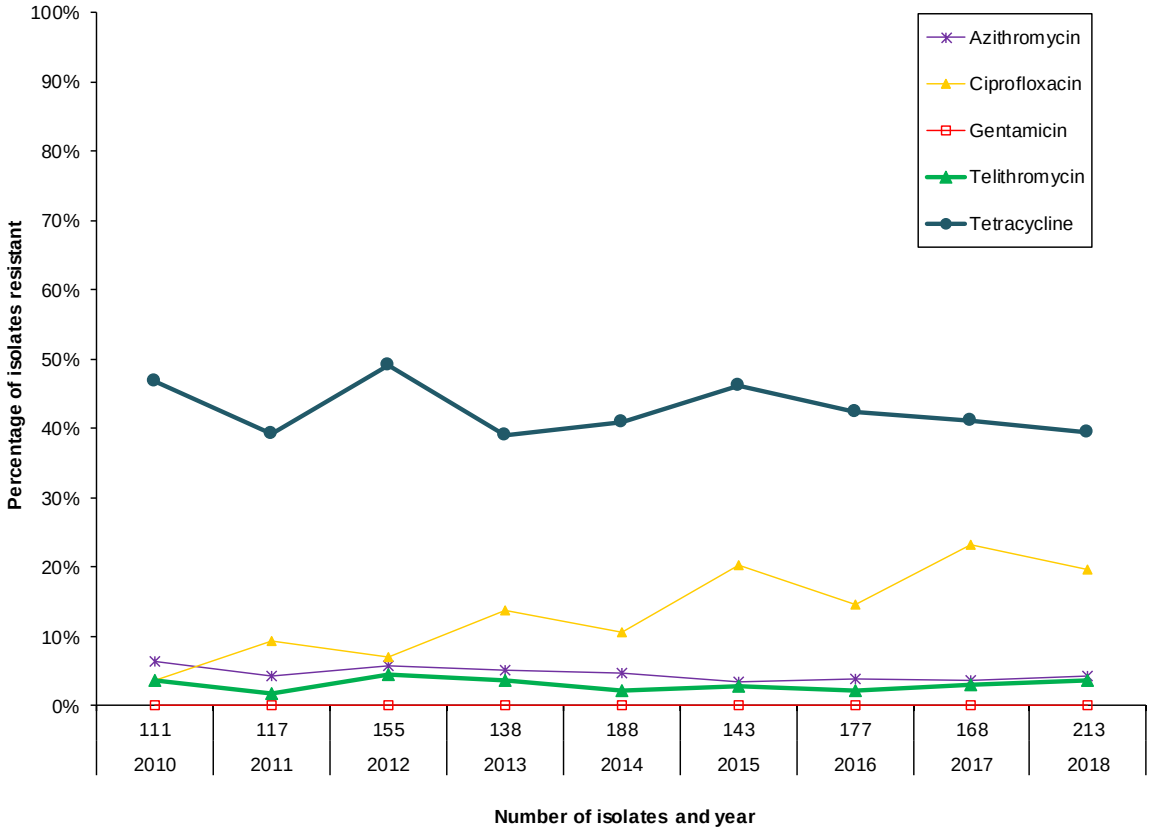
Figure 3. 21 Temporal variations in resistance of *Escherichia coli* isolates from chicken, 2009 to 2018



Year Number of isolates	2009 171	2010 119	2011 164	2012 173	2013 174	2014 170	2015 179	2016 207	2017 195	2018 227
Antimicrobial										
Ampicillin	**43%**	53%	40%	39%	39%	**39%**	41%	37%	**28%**	**30%**
Ceftriaxone	**31%**	38%	21%	18%	21%	**16%**	16%	10%	**5%**	**7%**
Gentamicin	**12%**	10%	13%	13%	11%	**16%**	22%	19%	**16%**	**26%**
Nalidixic acid	**5%**	4%	5%	8%	4%	**6%**	5%	6%	**6%**	**9%**
Streptomycin	**45%**	50%	50%	50%	45%	**57%**	60%	58%	**52%**	**57%**
Tetracycline	**44%**	52%	52%	51%	49%	**57%**	54%	48%	**41%**	**39%**
Trimethoprim-sulfamethoxazole	**9%**	10%	15%	15%	18%	**21%**	20%	17%	**18%**	**19%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years, 5 years, and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

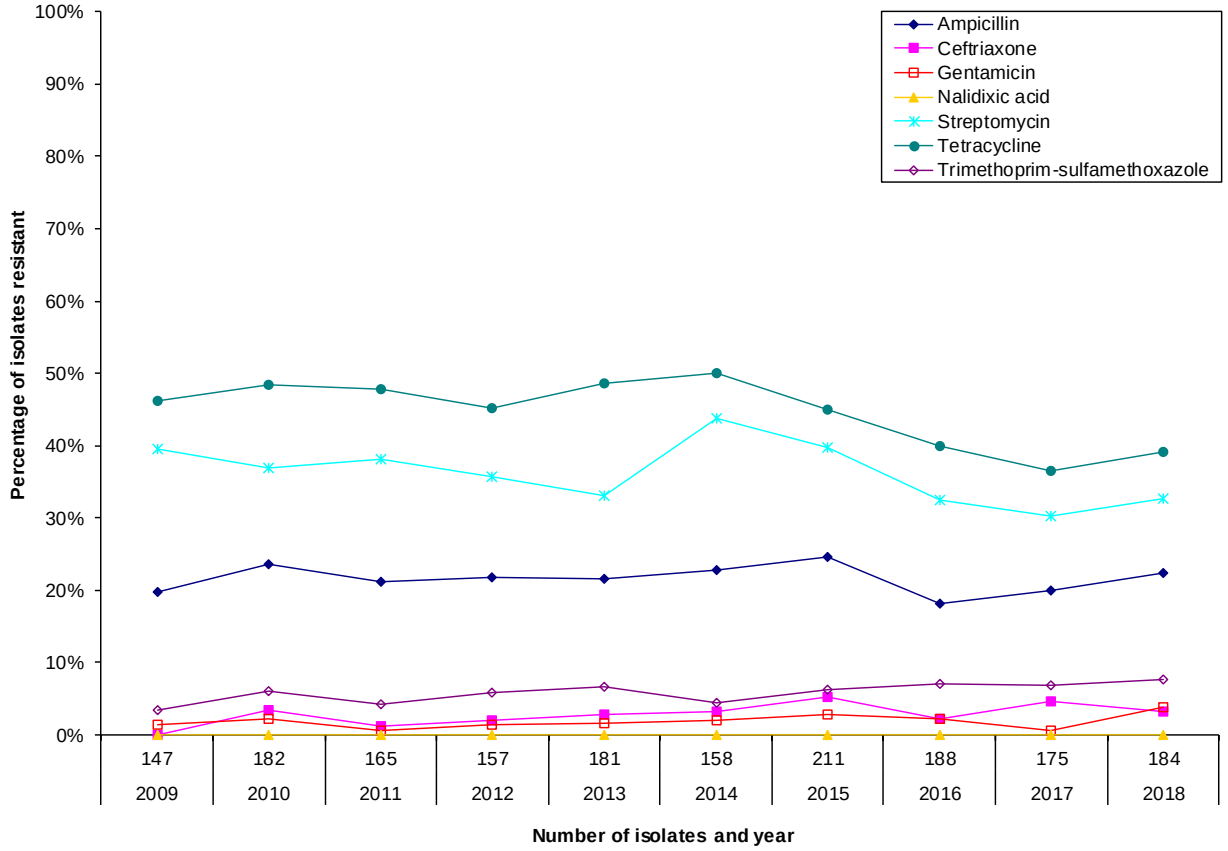
Figure 3. 22 Temporal variations in resistance of *Campylobacter* isolates from chickens, 2010 to 2018



Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	111	117	155	138	188	143	177	168	213
Antimicrobial									
Azithromycin	6%	4%	6%	5%	5%	3%	4%	4%	4%
Ciprofloxacin	4%	9%	7%	14%	11%	20%	15%	23%	20%
Gentamicin	0%	0%	0%	0%	0%	0%	0%	0%	0%
Telithromycin	4%	2%	5%	4%	2%	3%	2%	3%	4%
Tetracycline	47%	39%	49%	39%	41%	46%	42%	41%	39%

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years, 5 years, and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

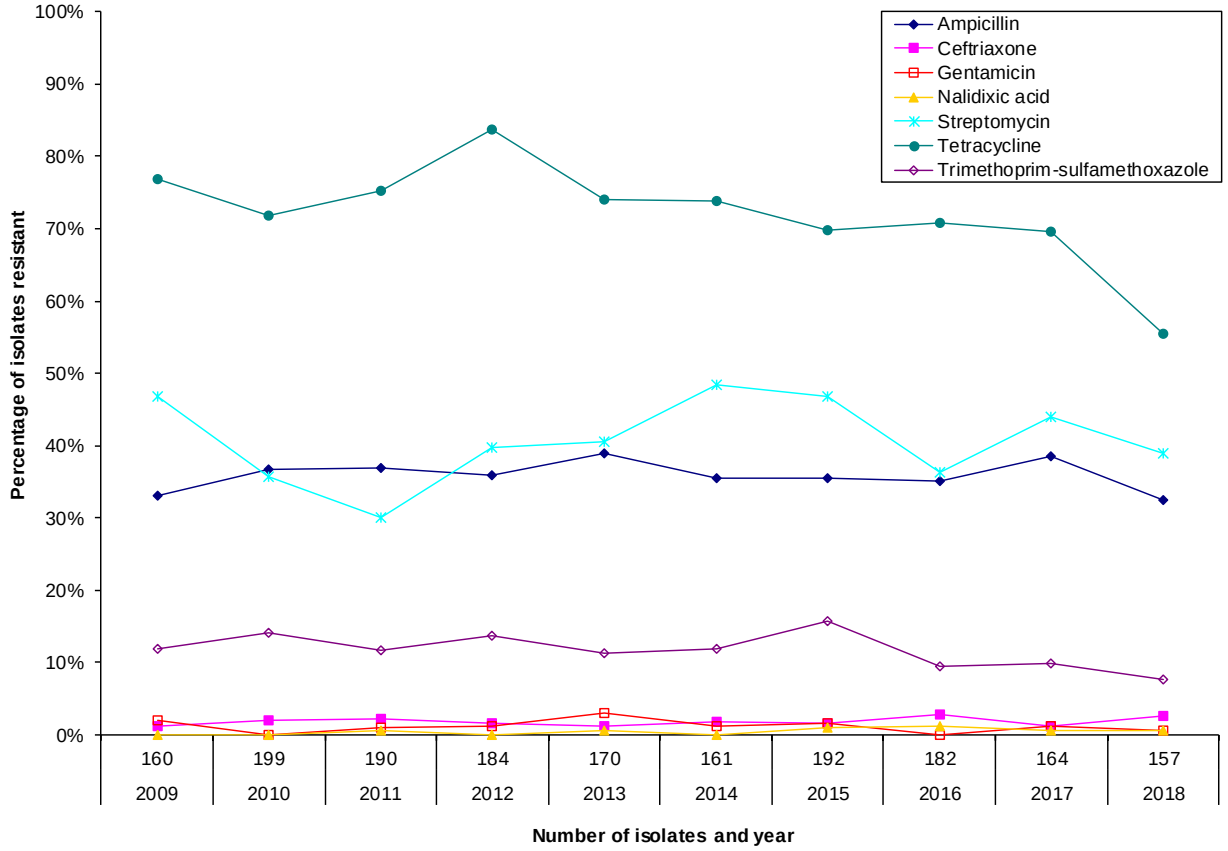
Figure 3. 23 Temporal variations in resistance of *Salmonella* isolates from pigs, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	147	182	165	157	181	158	211	188	175	184
Antimicrobial										
Ampicillin	20%	24%	21%	22%	22%	23%	25%	18%	20%	22%
Ceftriaxone	0%	3%	1%	2%	3%	3%	5%	2%	5%	3%
Gentamicin	1%	2%	1%	1%	2%	2%	3%	2%	1%	4%
Nalidixic acid	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Streptomycin	39%	37%	38%	36%	33%	44%	40%	32%	30%	33%
Tetracycline	46%	48%	48%	45%	49%	50%	45%	40%	37%	39%
Trimethoprim-sulfamethoxazole	3%	6%	4%	6%	7%	4%	6%	7%	7%	8%

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years, 5 years, and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

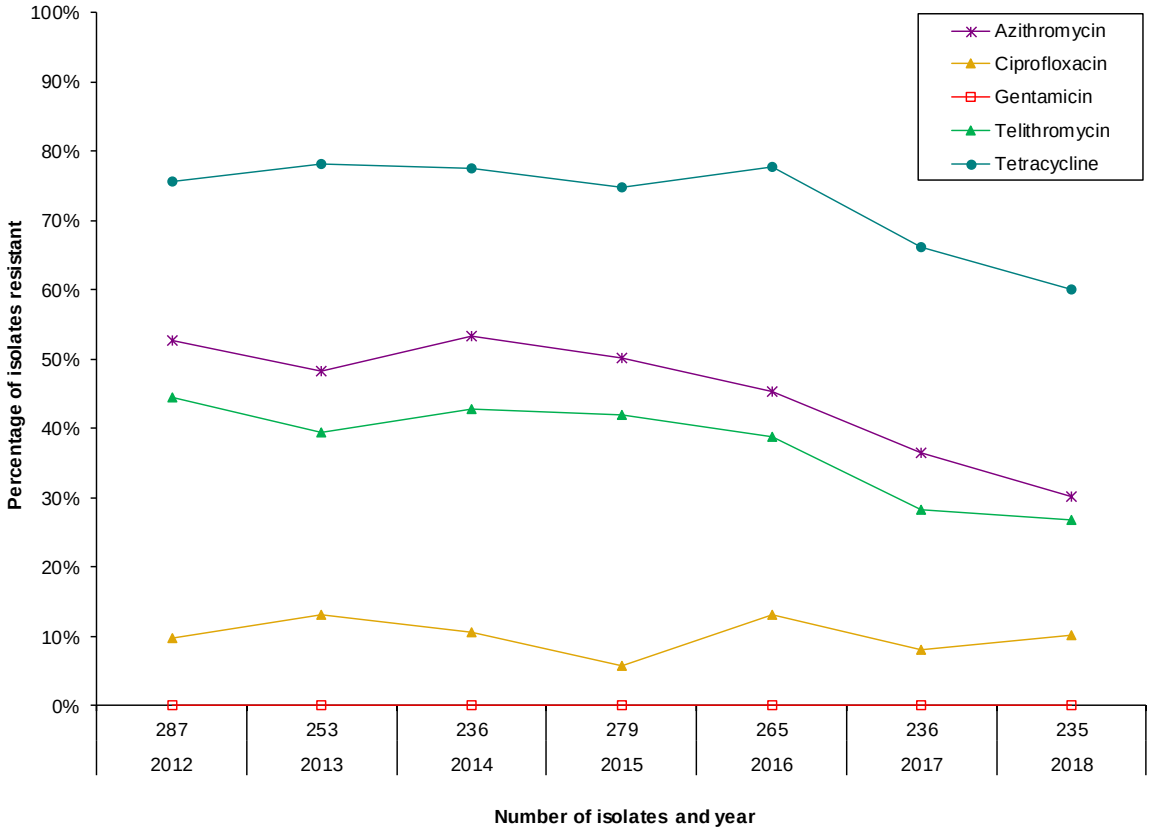
Figure 3. 24 Temporal variations in resistance of *Escherichia coli* isolates from pigs, 2009 to 2018



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of isolates	160	199	190	184	170	161	192	182	164	157
Antimicrobial										
Ampicillin	**33%**	37%	37%	36%	39%	**35%**	35%	35%	**38%**	**32%**
Ceftriaxone	**1%**	2%	2%	2%	1%	**2%**	2%	3%	**1%**	**3%**
Gentamicin	**2%**	0%	1%	1%	3%	**1%**	2%	0%	**1%**	**1%**
Nalidixic acid	**0%**	0%	1%	0%	1%	**0%**	1%	1%	**1%**	**1%**
Streptomycin	**47%**	36%	30%	40%	41%	**48%**	47%	36%	**44%**	**39%**
Tetracycline	**77%**	72%	75%	84%	74%	**74%**	70%	71%	**70%**	**55%**
Trimethoprim-sulfamethoxazole	**12%**	14%	12%	14%	11%	**12%**	16%	9%	**10%**	**8%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years, 5 years, and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

Figure 3. 25 Temporal variations in resistance of *Campylobacter* isolates from pigs, 2012 to 2018



Year Number of isolates	2012 287	2013 253	2014 236	2015 279	2016 265	2017 236	2018 235
Antimicrobial							
Azithromycin	**53%**	48%	**53%**	50%	45%	**36%**	**30%**
Ciprofloxacin	**10%**	13%	**11%**	6%	13%	**8%**	**10%**
Gentamicin	**0%**	0%	**0%**	0%	0%	**0%**	**0%**
Telithromycin	**45%**	40%	**43%**	42%	39%	**28%**	**27%**
Tetracycline	**76%**	78%	**78%**	75%	78%	**66%**	**60%**

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 10 years, 5 years, and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

Recovery results

Table 3. 18 Abattoir Surveillance recovery rates, 2002 to 2018

Animal species	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted						
		Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*
Beef cattle	2002	**97%**	76/78	**1%**	3/78			
	2003	**97%**	155/159	**< 1 %**	1/114			
	2004	**98%**	167/170					
	2005	**97%**	122/126			**66%**	23/35	
	2006	**100%**	150/150			**36%**	31/87	
	2007	**99%**	188/190			**39%**	75/190	
	2008	**97%**	176/182			**71%**[a]	129/182	
	2009	**94%**	119/126			**68%**	86/126	
	2010	**97%**[b]	77/79			**53%**[b]	37/70	
	2011	**99%**	139/141			**77%**	108/141	
	2012	**99%**	165/166			**92%**	152/166	
	2013	**100%**[b]	59/59			**92%**[b]	54/59	
	2014	**99%**	141/142			**87%**	123/142	
	2015	**98%**	149/152			**85%**	129/152	
	2016	**98%**	133/136			**76%**	104/136	
	2017	**98%**	148/151			**83%**	125/151	
	2018	**98%**	125/127			**85%**	108/127	
Chickens	2002	**100%**	40/40	**13%**	25/195			
	2003	**97%**	150/153	**16%**	126/803			
	2004	**99%**	130/131	**16%**	142/893			
	2005	**99%**	218/220	**18%**	200/1,103			
	2006	**100%**	166/166	**23%**	187/824			
	2007	**99%**	180/181	**25%**	204/808			
	2008	**99%**	170/171	**28%**	234/851			
	2009	**100%**	171/171	**27%**	230/851			
	2010	**99%**	119/120	**24%**	142/599	**19%**	111/599	
	2011	**99%**	164/166	**20%**	140/701	**17%**	117/696	
	2012	**100%**	173/173	**18%**[c]	126/684	**23%**	155/685	
	2013	**99%**	171/172	**16%**	105/672	**21%**	137/662	
	2014	**100%**	170/170	**15%**	103/684	**27%**	187/683	
	2015	**99%**	179/181	**18%**	128/708	**20%**	143/709	
	2016	**99%**	206/208	**14%**	120/840	**21%**	177/842	
	2017	**99%**	195/196	**16%**	127/785	**21%**	168/784	
	2018	**99%**	227/229	**13%**	118/915	**24%**	215/915	

See corresponding footnotes at the end of the table.

Table 3. 18 Abattoir Surveillance recovery rates, 2002 to 2018 (continued)

Animal species	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted						
		Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*
Pigs	2002	**97%**	38/39	**27%**	103/385			
	2003	**98%**	153/155	**28%**	395/1,393			
	2004	**99%**	142/143	**38%**	270/703			
	2005	**99%**	163/164	**42%**	212/486			
	2006	**98%**	115/117	**40%**	145/359			
	2007	**98%**	93/95	**36%**	105/296			
	2008	**100%**	150/150	**44%**	151/340			
	2009	**98%**	160/163	**45%**	147/327			
	2010	**98%**	199/203	**44%**	182/410			
	2011	**99%**	190/191	**43%**	165/382			
	2012	**100%**	184/184	**42%**	157/370	**78%**	289/370	
	2013	**99%**	166/168	**52%**	171/330	**76%**	237/314	
	2014	**99%**	161/162	**49%**	158/325	**73%**	237/325	
	2015	**98%**	192/195	**55%**	211/385	**72%**	279/385	
	2016	**99%**	182/184	**51%**	188/367	**72%**	265/366	
	2017	**98%**	164/167	**52%**	175/336	**71%**	237/336	
	2018	**97%**	157/162	**57%**	184/324	**73%**	235/324	

Grey-shaded areas indicate either: a) isolates recovered from sampling activities outside the scope of CIPARS routine (or "core") surveillance in the specified year (i.e. grey-shaded areas with data) or b) discontinuation or no surveillance activity (i.e. grey-shaded areas with no data).

[a] Implementation of a new *Campylobacter* recovery method in 2008 in abattoir beef cattle isolates.

[b] In 2010 and 2013, the number of samples received from abattoir beef cattle was much lower than anticipated due to a drop in submissions related to unavoidable operational issues at 2 major participating abattoirs.

[c] Decreased prevalence in chickens and one non-compliant plant (lack of sampling) resulted in a shortfall of *Salmonella* isolates from chickens.

Farm Surveillance

Multiclass resistance

Table 3. 19 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from feedlot cattle, 2018

Province or region	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Alberta	119 (100)	42	41	32	4			29	3					26	1		4		5	71

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Table 3. 20 Number of antimicrobial classes in resistance patterns of *Campylobacter* from feedlot cattle, 2018

Species	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial							
							Aminoglycosides	Ketolides	Lincosamides	Macrolides		Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	TEL	CLI	AZM	ERY	FLR	CIP	NAL	TET
Campylobacter coli	67 (71.3)	8	27	24	8			21	20	21	21		14	14	47
Campylobacter jejuni	27 (28.7)	11	13	3									3	3	16
Total	**94 (100)**	**19**	**40**	**27**	**8**			**21**	**20**	**21**	**21**		**17**	**17**	**63**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Table 3. 21 Number of antimicrobial classes in resistance patterns of *Salmonella* from chickens pre-harvest, 2018

Province or region / serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial												
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones	Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
British Columbia																				
Kentucky	30 (50.0)		1	20	9			29	17	17	17	15							9	29
Enteritidis	23 (38.3)	22			1			1	1					1						1
Infantis	3 (5.0)	1	2						2	2	2	2								
Heidelberg	2 (3.3)	1		1			1	1						1						
Senftenberg	2 (3.3)	1	1					1												
Total	**60 (100)**	**25**	**4**	**21**	**10**		**1**	**32**	**20**	**19**	**19**	**17**		**2**					**9**	**30**
Prairies																				
Enteritidis	34 (33.0)	34																		
Kentucky	27 (26.2)	10	2	15				15	7	7	7	7								15
Lille	12 (11.7)	12																		
Schwarzengrund	11 (10.7)	11																		
Typhimurium	4 (3.9)	3	1																	1
Heidelberg	3 (2.9)	3																		
Newport	3 (2.9)	3																		
Less common serovars	9 (8.7)	7		2				2												2
Total	**103 (100)**	**83**	**3**	**17**				**17**	**7**	**7**	**7**	**7**								**18**
Ontario																				
Enteritidis	11 (18.6)	11																		
Heidelberg	11 (18.6)	7	3	1				2	3	3	3	3								
Litchfield	8 (13.6)	5	2	1			1	3						1						
Livingstone	7 (11.9)		4	3				3												7
Liverpool	6 (10.2)	2	3	1				2						1	1					3
Hadar	5 (8.5)			5				5												5
Typhimurium	3 (5.1)			3										3						3
Uganda	3 (5.1)	3																		
Muenchen	2 (3.4)			2				2						2						2
Less common serovars	3 (5.1)	2		1				1												1
Total	**59 (100)**	**30**	**12**	**17**			**1**	**18**	**3**	**3**	**3**	**3**		**7**	**1**					**21**
Québec																				
Kentucky	47 (78.3)	2	2	43			1	44	9	9	9	7		1						44
Worthington	6 (10.0)	6																		
Hadar	3 (5.0)			3				3												3
Enteritidis	2 (3.3)	2																		
Less common serovars	2 (3.3)		1	1				2						1						1
Total	**60 (100)**	**10**	**3**	**47**			**1**	**49**	**9**	**9**	**9**	**7**		**2**						**48**
National																				
Kentucky	105 (37.2)	12	5	79	9		1	89	33	33	33	29		1					9	89
Enteritidis	70 (24.8)	69			1			1	1					1						1
Heidelberg	16 (5.7)	11	3	2			1	3	3	3	3	3		1						
Lille	12 (4.3)	12																		
Schwarzengrund	12 (4.3)	11		1				1						1						1
Hadar	8 (2.8)			8				8												8
Litchfield	8 (2.8)	5	2	1			1	3						1						
Typhimurium	8 (2.8)	3	2	3				1						3						4
Livingstone	7 (2.5)		4	3				3												7
Less common serovars	36 (12.8)	25	6	5				7	2	2	2	2		3	1					7
Total	**282 (100)**	**148**	**22**	**102**	**10**		**3**	**116**	**39**	**38**	**38**	**34**		**11**	**1**				**9**	**117**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

The Prairies region includes Alberta and Saskatchewan.

Table 3. 22 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from chickens at pre-harvest, 2018

Province or region	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
British Columbia	120 (21.9)	27	26	36	29	2	30	54	64	21	22	21		43	5		6	2	30	46
Prairies	175 (32.0)	81	31	49	14		24	61	25	5	5	5		42	3		4		10	60
Ontario	144 (26.3)	56	19	43	26		30	54	44	5	3	5		51	28	5	8		6	65
Québec	108 (19.7)	13	9	67	19		27	83	41	9	8	9		67	32	2	9		7	56
National	**547 (100)**	**177**	**85**	**195**	**88**	**2**	**111**	**252**	**174**	**40**	**38**	**40**		**203**	**68**	**7**	**27**	**2**	**53**	**227**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

The Prairies region includes Alberta and Saskatchewan.

Table 3. 23 Number of antimicrobial classes in resistance patterns of *Campylobacter* from chickens at pre-harvest, 2018

Province or region / species	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial							
							Aminoglycosides	Ketolides	Lincosamides	Macrolides		Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	TEL	CLI	AZM	ERY	FLR	CIP	NAL	TET
British Columbia															
Campylobacter coli	11 (23.9)	3	4	4									8	8	4
Campylobacter jejuni	35 (76.0)	31	4												4
Total	**46 (100)**	**34**	**8**	**4**									**8**	**8**	**8**
Prairies															
Campylobacter jejuni	45 (100)	25	20												20
Total	**45 (100)**	**25**	**20**												**20**
Ontario															
Campylobacter coli	3 (20.0)	3													
Campylobacter jejuni	12 (80.0)	12													
Total	**15 (100)**	**15**													
Québec															
Campylobacter jejuni	16 (100)	8		8									8	8	8
Total	**16 (100)**	**8**		**8**									**8**	**8**	**8**
National															
Campylobacter coli	14 (11.5)	6	4	4									8	8	4
Campylobacter jejuni	108 (88.5)	76	24	8									8	8	32
Total	**122 (100)**	**82**	**28**	**12**									**16**	**16**	**36**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

The Prairies region includes Alberta and Saskatchewan.

Table 3. 24 Number of antimicrobial classes in resistance patterns of *Salmonella* from pigs, 2018

Province or region / serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Prairies																				
Brandenburg	9 (18.4)	4	2	3				3	2											3
Derby	9 (18.4)		5	3	1			4	4	4	4	4		4						6
Livingstone	5 (10.2)	5																		
Agona	4 (8.2)	4																		
Infantis	4 (8.2)	1	2	1				1						3	3					
Schwarzengrund	4 (8.2)	2		2				2						2						2
Give	3 (6.1)	3																		
Mbandaka	3 (6.1)	1		2				2						1						2
Typhimurium	3 (6.1)	1	2				2													
Putten	2 (4.1)	2																		
Bovismorbificans	1 (2.0)	1																		
4,[5],12:i:-	1 (2.0)	1																		
Rissen	1 (2.0)	1																		
Total	**49 (100)**	**26**	**11**	**11**	**1**		**2**	**12**	**6**	**4**	**4**	**4**		**10**	**3**					**13**
Ontario																				
Typhimurium	17 (34.7)	2		5	10		3	10	15					15			9			15
Infantis	8 (16.3)	6			2			2	2	2	2	2		2			1			2
Derby	6 (12.2)	2		3	1			4	1	1	1	1		4						4
Worthington	6 (12.2)	5		1					1		1			1						1
Brandenburg	5 (10.2)	2	3																	3
4,[5],12:i:-	4 (8.2)				4		1	4	4					4						4
Mbandaka	2 (4.1)			1	1		1	2	1	1	1	1		1	1		1			2
Othmarschen	1 (2.0)				1			1						1			1			1
Total	**49 (100)**	**17**	**3**	**10**	**19**		**5**	**23**	**24**	**4**	**5**	**4**		**28**	**1**		**12**			**32**
Québec																				
Typhimurium	18 (43.9)	2	1	5	10		1	15	9					15	6	3	7			15
4,[5],12:i:-	10 (24.4)	1			9			9	9	1	1	1		9						9
Brandenburg	8 (19.5)	6	2					1	1											
Infantis	4 (9.8)	2			2			2						2	2		2			2
Derby	1 (2.4)			1				1						1						1
Total	**41 (100)**	**11**	**3**	**6**	**21**		**1**	**28**	**19**	**1**	**1**	**1**		**27**	**8**	**3**	**9**			**27**
National																				
Typhimurium	38 (27.3)	5	3	10	20		6	25	24					30	6	3	16			30
Brandenburg	22 (15.8)	12	7	3				4	3											6
Derby	16 (11.5)	2	5	7	2			9	5	5	5	5		9						11
Infantis	16 (11.5)	9	2	1	4			5	2	2	2	2		7	5		3			4
4,[5],12:i:-	15 (10.8)	2			13		1	13	13	1	1	1		13						13
Worthington	6 (4.3)	5		1					1		1			1						1
Livingstone	5 (3.6)	5																		
Mbandaka	5 (3.6)	1		3	1		1	4	1	1	1	1		2	1		1			4
Agona	4 (2.9)	4																		
Schwarzengrund	4 (2.9)	2		2				2						2						2
Give	3 (2.2)	3																		
Less common serovars	5 (3.6)	4			1			1						1			1			1
Total	**139 (100)**	**54**	**17**	**27**	**41**		**8**	**63**	**49**	**9**	**10**	**9**		**65**	**12**	**3**	**21**			**72**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

The Prairies region includes Alberta, Saskatchewan, and Manitoba.

Table 3. 25 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from pigs, 2018

Province or region	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Prairies	269 (46.0)	84	63	87	34	1	1	99	61	6	6	6		75	15		34	2	4	153
Ontario	184 (31.5)	20	48	79	37		4	95	73	2	2	2		66	19	1	32		1	144
Québec	132 (22.6)	26	31	48	26	1	5	58	33	3	2	2		56	37		22		1	97
National	**585 (100)**	**130**	**142**	**214**	**97**	**2**	**10**	**252**	**167**	**11**	**10**	**10**		**197**	**71**	**1**	**88**	**2**	**6**	**394**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

The Prairies region includes Alberta, Saskatchewan, and Manitoba.

Table 3. 26 Number of antimicrobial classes in resistance patterns of *Campylobacter* from pigs, 2018

Province or region / species	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial							
							Aminoglycosides	Ketolides	Lincosamides	Macrolides		Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	TEL	CLI	AZM	ERY	FLR	CIP	NAL	TET
Prairies															
Campylobacter coli	219 (100)	81	50	50	38			69	70	73	73		16	16	106
Total	**219 (100)**	**81**	**50**	**50**	**38**			**69**	**70**	**73**	**73**		**16**	**16**	**106**
Ontario															
Campylobacter coli	150 (100)	24	30	37	59			75	81	91	91		12	12	114
Total	**150 (100)**	**24**	**30**	**37**	**59**			**75**	**81**	**91**	**91**		**12**	**12**	**114**
Québec															
Campylobacter coli	113 (99.1)	22	46	35	10			19	22	23	23		26	26	83
Campylobacter spp.	1 (0.9)			1										1	1
Total	**114 (100)**	**22**	**46**	**36**	**10**			**19**	**22**	**23**	**23**		**26**	**27**	**84**
National															
Campylobacter coli	482 (99.8)	127	126	122	107			163	173	187	187		54	54	303
Campylobacter spp.	1 (0.2)			1										1	1
Total	**483 (100)**	**127**	**126**	**123**	**107**			**163**	**173**	**187**	**187**		**54**	**55**	**304**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Campylobacter spp. include unidentified species, some of which may be intrinsically resistant to nalidixic acid.

The Prairies region includes Alberta, Saskatchewan, and Manitoba.

Table 3. 27 Number of antimicrobial classes in resistance patterns of *Salmonella* from turkeys, 2018

Province / serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams				Folate pathway inhibitor		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	ME	SS	SX	AZM	CHL	CIP	NAL	TET
British Columbia																				
Reading	19 (28.8)	6	8		5			5	13					5						5
Hadar	17 (25.8)			17				17	9											17
Uganda	8 (12.1)	5		3				3						3						3
Enteritidis	7 (10.6)	7																		
Agona	5 (7.6)			5			5	5						5						5
Muenchen	3 (4.5)	3																		
Anatum	2 (3.0)			2			1	2	1											2
Senftenberg	2 (3.0)	1		1				1						1						1
Less common serovars	3 (4.5)	2		1				1						1						1
Total	**66 (100)**	**24**	**8**	**29**	**5**		**6**	**34**	**23**					**15**						**34**
Alberta																				
Reading	14 (45.2)	5	7		2			2	9					2						2
Uganda	12 (38.7)	12																		
Schwarzengrund	3 (9.8)	2	1					1												
Senftenberg	2 (6.5)				2		2	2	2					2			2			2
Total	**31 (100)**	**19**	**8**		**4**		**2**	**5**	**11**					**4**			**2**			**4**
Ontario																				
Uganda	51 (52.6)	7		44				44						44						44
Muenchen	13 (13.4)	9		4				4						4						4
Schwarzengrund	13 (13.4)	13																		
Albany	5 (5.2)	2	2	1			1	3												1
Agona	4 (4.1)			4										4						4
Hadar	4 (4.1)			4				4												4
Livingstone	3 (3.1)		2	1				1												3
Less common serovars	4 (4.1)	3		1			1	1						1						
Total	**97 (100)**	**34**	**4**	**59**			**2**	**57**						**53**						**60**
Québec																				
Heidelberg	28 (62.2)	23	2	3			2	4	1					2						1
Uganda	8 (17.8)	2		6				6						6						6
Schwarzengrund	5 (11.1)	2		3				3						3						3
Agona	4 (8.9)	4																		
Total	**45 (100)**	**31**	**2**	**12**			**2**	**13**	**1**					**11**						**10**
National																				
Uganda	79 (33.1)	26		53				53						53						53
Reading	33 (13.8)	11	15		7			7	22					7						7
Heidelberg	29 (12.1)	23	2	4			3	5	1					3						1
Schwarzengrund	22 (9.2)	18	1	3				4						3						3
Hadar	21 (8.8)			21				21	9											21
Muenchen	16 (6.7)	12		4				4						4						4
Agona	13 (5.4)	4		9			5	5						9						9
Enteritidis	7 (2.9)	7																		
Albany	5 (2.1)	2	2	1			1	3												1
Senftenberg	5 (2.1)	2		1	2		2	3	2					3			2			3
Less common serovars	9 (3.8)	3	2	4			1	4	1					1						6
Total	**239 (100)**	**108**	**22**	**100**	**9**		**12**	**109**	**35**					**83**			**2**			**108**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

Table 3. 28 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from turkeys, 2018

Province	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitor		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	ME	SS	SXT	AZM	CHL	CIP	NAL	TET
British Columbia	118 (32.1)	34	16	54	13	1	29	51	36	3	2	2		32	2		8	2	4	67
Alberta	39 (10.6)	14	8	14	3		7	16	10					9					1	19
Ontario	118 (32.1)	44	24	39	11		9	39	23					27	13	1	3			67
Québec	92 (25.1)	23	17	40	12		5	34	39		1			34	24		1			53
National	**367 (100)**	**115**	**65**	**147**	**39**	**1**	**50**	**140**	**108**	**3**	**3**	**2**		**102**	**39**	**1**	**12**	**2**	**5**	**206**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Table 3. 29 Number of antimicrobial classes in resistance patterns of *Campylobacter* from turkeys, 2018

Province / species	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance					Number of isolates resistant by antimicrobial class and antimicrobial								
							Aminoglycosides	Ketolides	Lincosamides	Macrolides		Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	TEL	CLI	AZM	ERY	FLR	CIP	NAL	TET
British Columbia															
Campylobacter coli	33 (35.1)		23	10						2	2		27	27	14
Campylobacter jejuni	61 (64.9)	20	28	13									30	30	24
Total	**94 (100)**	**20**	**51**	**23**						**2**	**2**		**57**	**57**	**38**
Alberta															
Campylobacter jejuni	14 (100)	7	5	2									2	2	7
Total	**14 (100)**	**7**	**5**	**2**									**2**	**2**	**7**
Ontario															
Campylobacter coli	31 (53.4)	10	7	14					4	4	4		10	10	18
Campylobacter jejuni	27 (46.6)	17	7	3									3	3	10
Total	**58 (100)**	**27**	**14**	**17**					**4**	**4**	**4**		**13**	**13**	**28**
Québec															
Campylobacter coli	9 (36.0)		6	3					3	9	9				
Campylobacter jejuni	16 (64.0)	9	5	2									2	2	7
Total	**25 (100)**	**9**	**11**	**5**					**3**	**9**	**9**		**2**	**2**	**7**
National															
Campylobacter coli	73 (38.2)	10	36	27					7	15	15		37	37	32
Campylobacter jejuni	118 (61.7)	53	45	20									37	37	48
Total	**191 (100)**	**63**	**81**	**47**					**7**	**15**	**15**		**74**	**74**	**80**

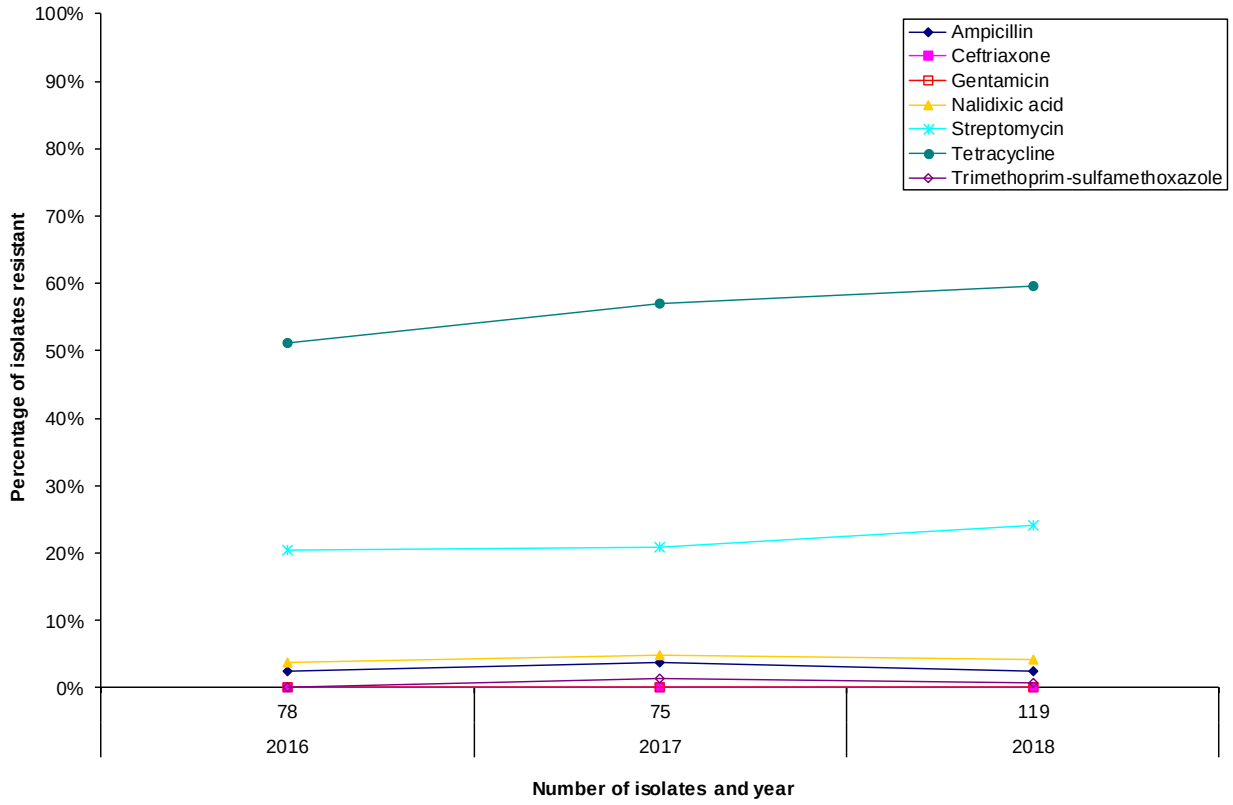
Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Campylobacter spp. include unidentified species, some of which may be intrinsically resistant to nalidixic acid.

Temporal antimicrobial resistance summary

Figure 3. 26 Temporal variations in resistance of *Escherichia coli* isolates from feedlot cattle, 2016 to 2018

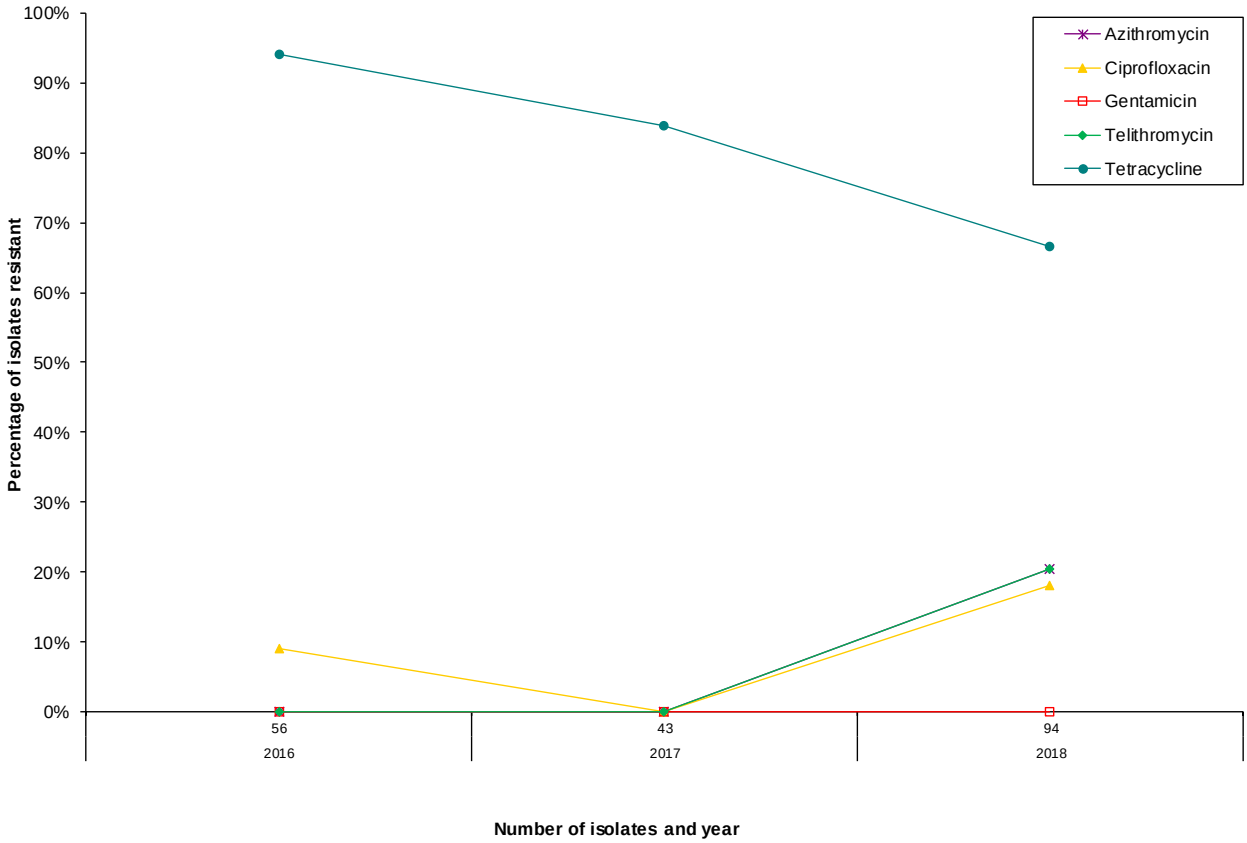


Year Number of isolates	2016 78	2017 75	2018 119
Antimicrobial			
Ampicillin	**3%**	**4%**	**2%**
Ceftriaxone	**0%**	**0%**	**0%**
Gentamicin	**0%**	**0%**	**0%**
Nalidixic acid	**4%**	**5%**	**4%**
Streptomycin	**21%**	**21%**	**24%**
Tetracycline	**51%**	**57%**	**60%**
Trimethoprim-sulfamethoxazole	**0%**	**1%**	**1%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per feedlot.

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the first year of surveillance and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

Figure 3. 27 Temporal variations in resistance of *Campylobacter* isolates from feedlot cattle, 2016 to 2018

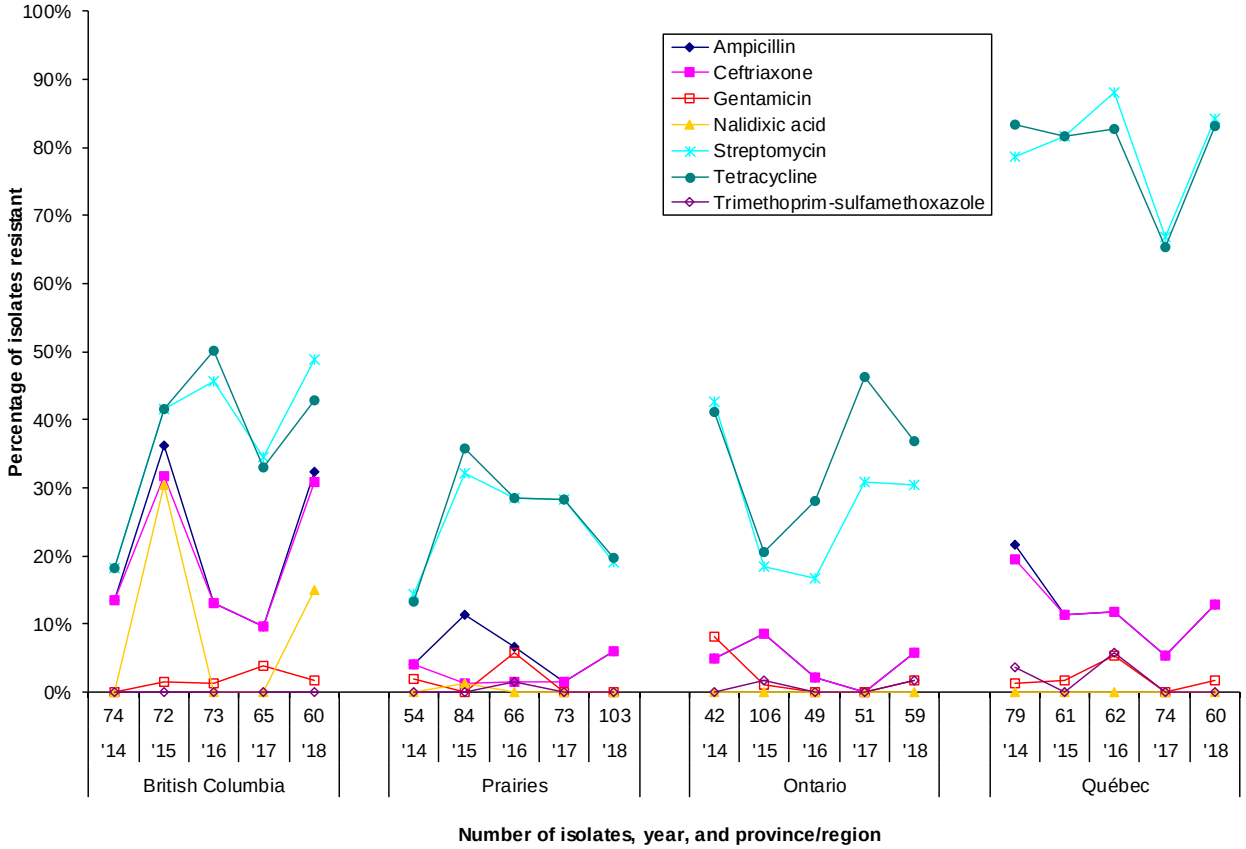


Year Number of isolates	2016 56	2017 43	2018 94
Antimicrobial			
Azithromycin	**0%**	**0%**	**20%**
Ciprofloxacin	**9%**	**0%**	**18%**
Gentamicin	**0%**	**0%**	**0%**
Telithromycin	**0%**	**0%**	**20%**
Tetracycline	**94%**	**84%**	**67%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per feedlot.

For the temporal analyses, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the first year of surveillance and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

Figure 3. 28 Temporal variations in resistance of *Salmonella* isolates from chickens at pre-harvest, 2014 to 2018



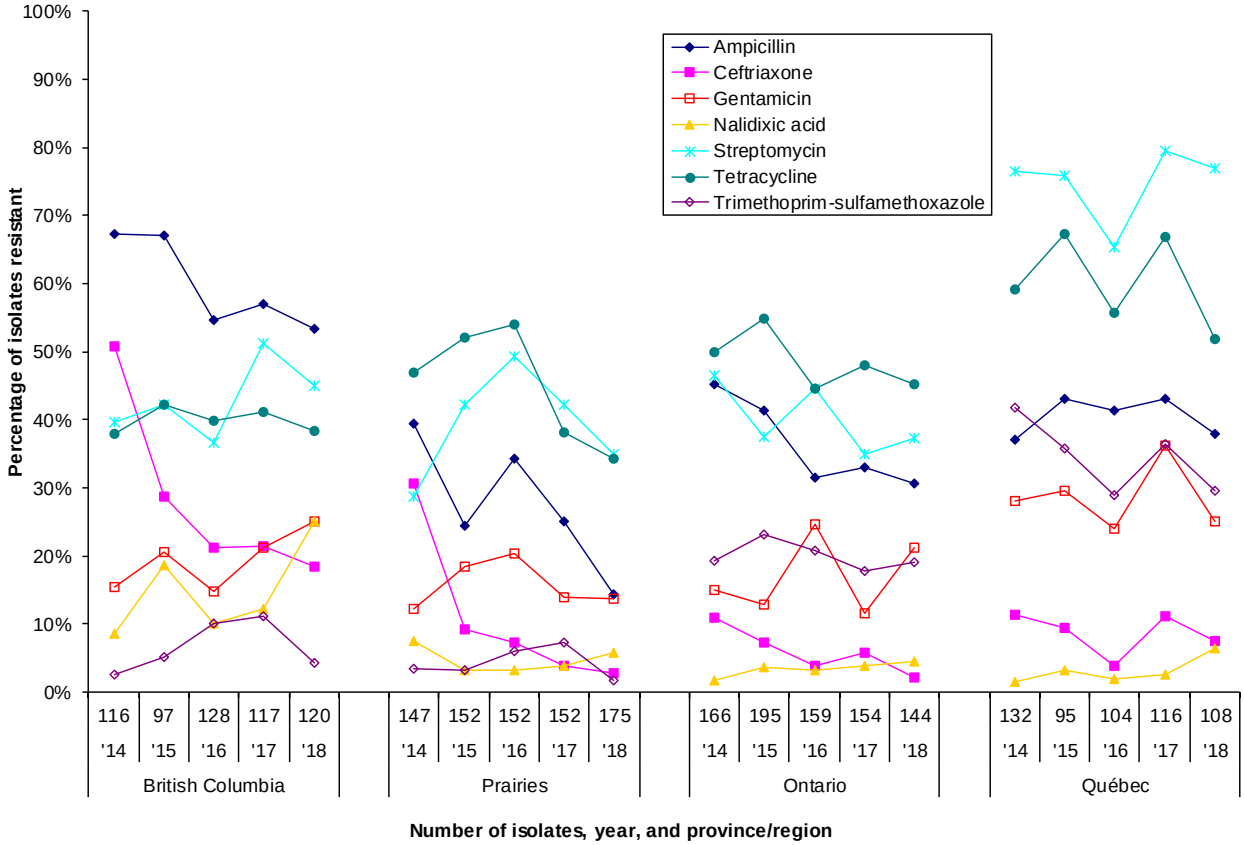
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	74	72	73	65	60	54	84	66	73	103	42	106	49	51	59	79	61	62	74	60
Antimicrobial																				
Ampicillin	**14%**	36%	13%	**10%**	**32%**	**4%**	11%	7%	**1%**	**6%**	**5%**	8%	2%	**0%**	**6%**	**22%**	11%	12%	**5%**	**13%**
Ceftriaxone	**14%**	32%	13%	**10%**	**31%**	**4%**	1%	2%	**1%**	**6%**	**5%**	8%	2%	**0%**	**6%**	**20%**	11%	12%	**5%**	**13%**
Gentamicin	**0%**	1%	1%	**4%**	**2%**	**2%**	0%	6%	**0%**	**0%**	**8%**	1%	0%	**0%**	**2%**	**1%**	2%	5%	**0%**	**2%**
Nalidixic acid	**0%**	30%	0%	**0%**	**15%**	**0%**	1%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
Streptomycin	**18%**	42%	46%	**35%**	**49%**	**14%**	32%	28%	**28%**	**19%**	**43%**	18%	17%	**31%**	**30%**	**79%**	82%	88%	**67%**	**84%**
Tetracycline	**18%**	42%	50%	**33%**	**43%**	**13%**	36%	28%	**28%**	**20%**	**41%**	20%	28%	**46%**	**37%**	**83%**	82%	83%	**65%**	**83%**
Trimethoprim-sulfamethoxazole	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	2%	**0%**	**0%**	**0%**	2%	0%	**0%**	**2%**	**4%**	0%	6%	**0%**	**0%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 3. 29 Temporal variations in resistance of *Escherichia coli* isolates from chickens at pre-harvest, 2014 to 2018



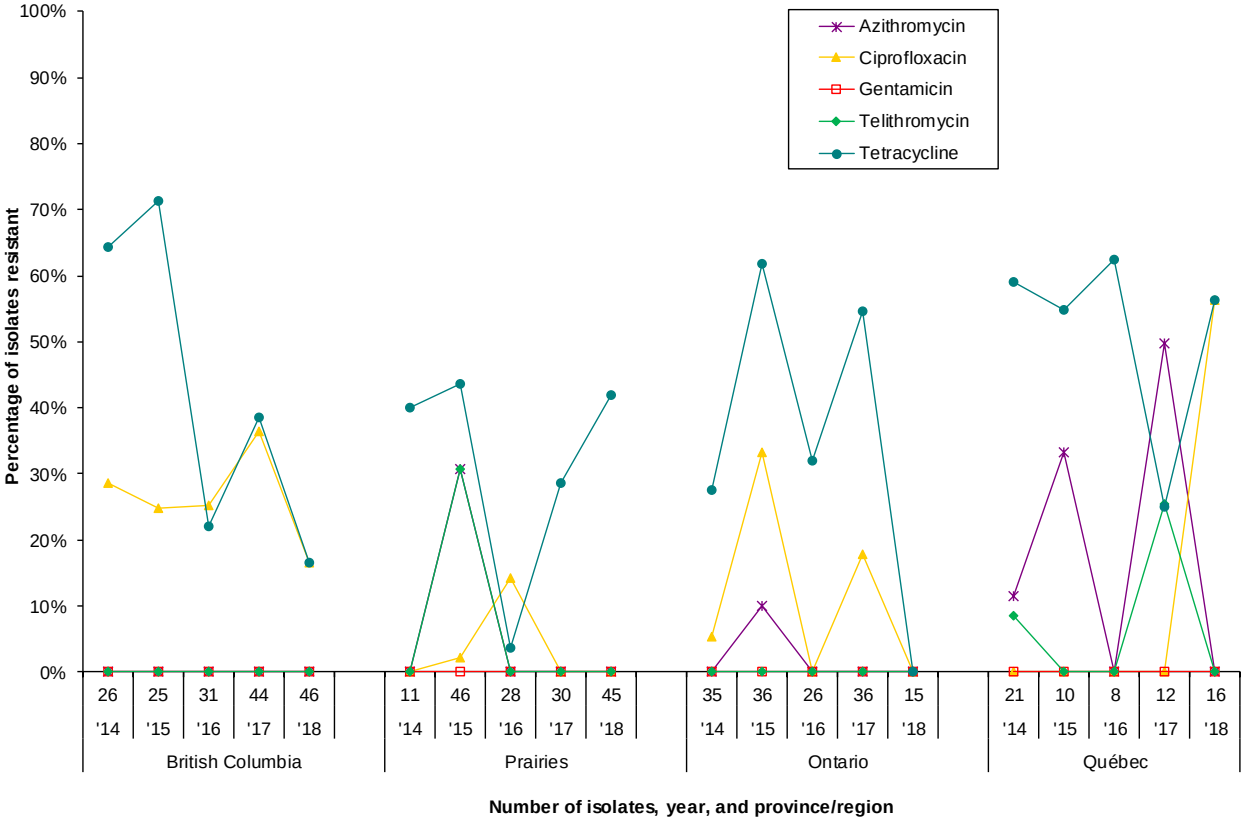
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	116	97	128	117	120	147	152	152	152	175	166	195	159	154	144	132	95	104	116	108
Antimicrobial																				
Ampicillin	**67%**	67%	55%	**57%**	**53%**	**39%**	24%	34%	**25%**	**14%**	**45%**	41%	31%	**33%**	**31%**	**37%**	43%	41%	**43%**	**38%**
Ceftriaxone	**51%**	29%	21%	**21%**	**18%**	**31%**	9%	7%	**4%**	**3%**	**11%**	7%	4%	**6%**	**2%**	**11%**	9%	4%	**11%**	**7%**
Gentamicin	**16%**	21%	15%	**21%**	**25%**	**12%**	18%	20%	**14%**	**14%**	**15%**	13%	25%	**12%**	**21%**	**28%**	29%	24%	**36%**	**25%**
Nalidixic acid	**9%**	19%	10%	**12%**	**25%**	**7%**	3%	3%	**4%**	**6%**	**2%**	4%	3%	**4%**	**4%**	**2%**	3%	2%	**3%**	**6%**
Streptomycin	**40%**	42%	37%	**51%**	**45%**	**29%**	42%	49%	**42%**	**35%**	**46%**	37%	45%	**35%**	**37%**	**77%**	76%	65%	**79%**	**77%**
Tetracycline	**38%**	42%	40%	**41%**	**38%**	**47%**	52%	54%	**38%**	**34%**	**50%**	55%	45%	**48%**	**45%**	**59%**	67%	56%	**67%**	**52%**
Trimethoprim-sulfamethoxazole	**3%**	5%	10%	**11%**	**4%**	**3%**	3%	6%	**7%**	**2%**	**19%**	23%	21%	**18%**	**19%**	**42%**	36%	29%	**36%**	**30%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 3. 30 Temporal variations in resistance of *Campylobacter* isolates from chickens at pre-harvest, 2014 to 2018



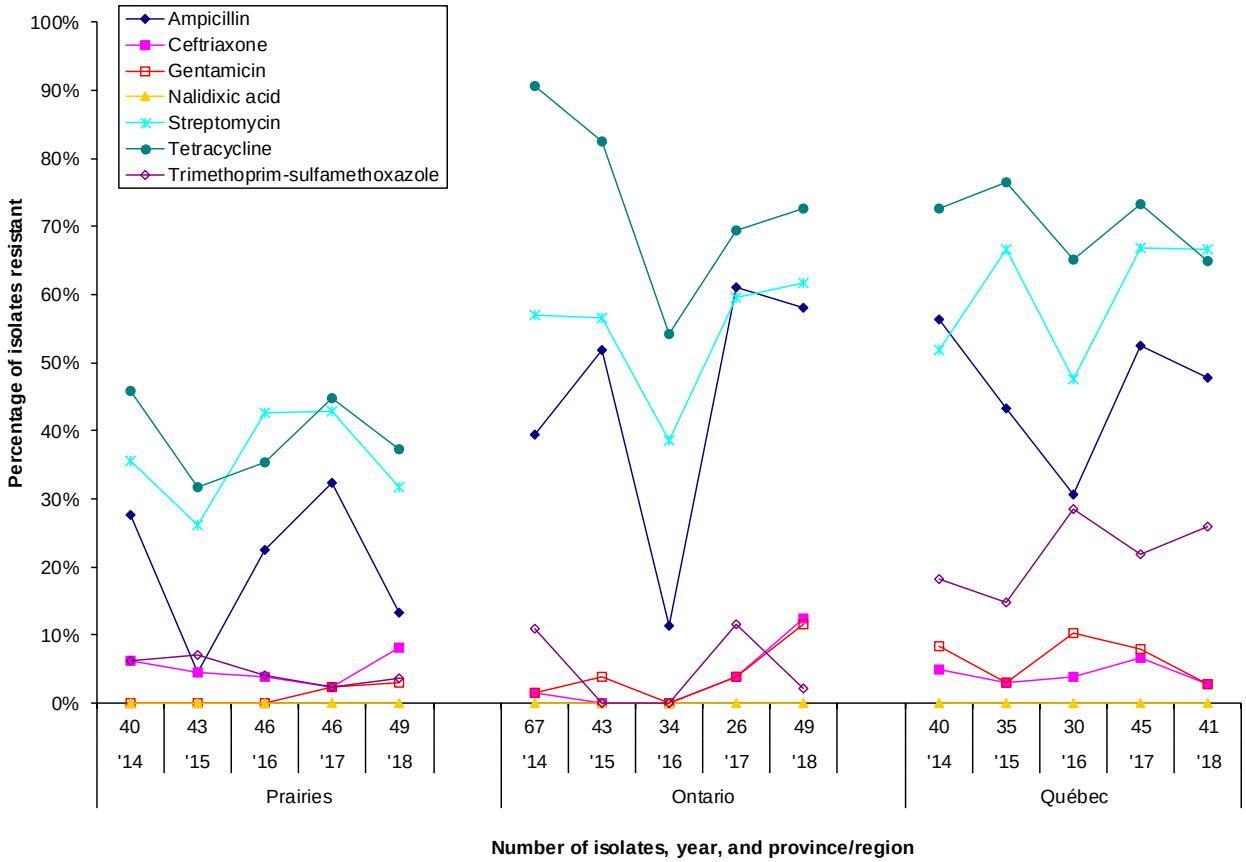
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	26	25	31	44	46	11	46	28	30	45	35	36	26	36	15	21	10	8	12	16
Antimicrobial																				
Azithromycin	**0%**	0%	0%	**0%**	**0%**	0%	31%	0%	**0%**	**0%**	**0%**	10%	0%	**0%**	**0%**	**12%**	33%	0%	**50%**	**0%**
Ciprofloxacin	**29%**	25%	25%	**36%**	**17%**	0%	2%	14%	**0%**	**0%**	**5%**	33%	0%	**18%**	**0%**	**0%**	0%	0%	**0%**	**56%**
Gentamicin	**0%**	0%	0%	**0%**	**0%**	0%	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
Telithromycin	**0%**	0%	0%	**0%**	**0%**	0%	31%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**9%**	0%	0%	**25%**	**0%**
Tetracycline	**64%**	71%	22%	**39%**	**17%**	40%	44%	4%	**29%**	**42%**	**28%**	62%	32%	**55%**	**0%**	**59%**	55%	63%	**25%**	**56%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 3. 31 Temporal variations in resistance of *Salmonella* isolates from pigs, 2014 to 2018



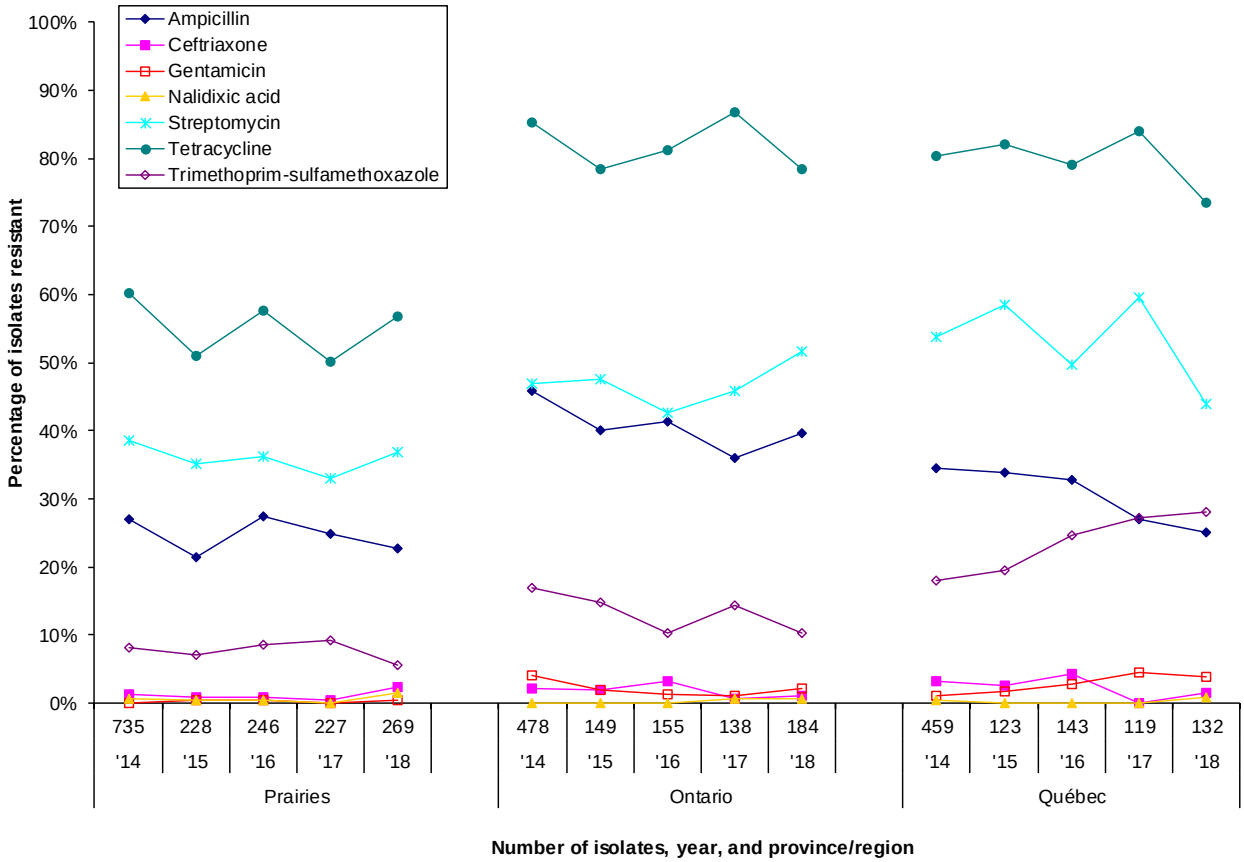
Province/region	Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	40	43	46	46	49	67	43	34	26	49	40	35	30	45	41
Antimicrobial															
Ampicillin	**28%**	5%	23%	**32%**	**13%**	**39%**	52%	11%	**61%**	**58%**	**56%**	43%	31%	**52%**	**48%**
Cefriaxone	**6%**	5%	4%	**2%**	**8%**	**1%**	0%	0%	**4%**	**12%**	**5%**	3%	4%	**7%**	**3%**
Gentamicin	**0%**	0%	0%	**2%**	**3%**	**1%**	4%	0%	**4%**	**11%**	**8%**	3%	10%	**8%**	**3%**
Nalidixic acid	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
Streptomycin	**36%**	26%	43%	**43%**	**32%**	**57%**	57%	39%	**60%**	**62%**	**52%**	67%	48%	**67%**	**67%**
Tetracycline	**46%**	32%	35%	**45%**	**37%**	**91%**	83%	54%	**69%**	**73%**	**73%**	77%	65%	**73%**	**65%**
Trimethoprim-sulfamethoxazole	**6%**	7%	4%	**2%**	**4%**	**11%**	0%	0%	**11%**	**2%**	**18%**	15%	29%	**22%**	**26%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per herd.

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicate significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

The Prairies region includes Alberta, Saskatchewan, and Manitoba.

Figure 3. 32 Temporal variations in resistance of *Escherichia coli* isolates from pigs, 2014 to 2018



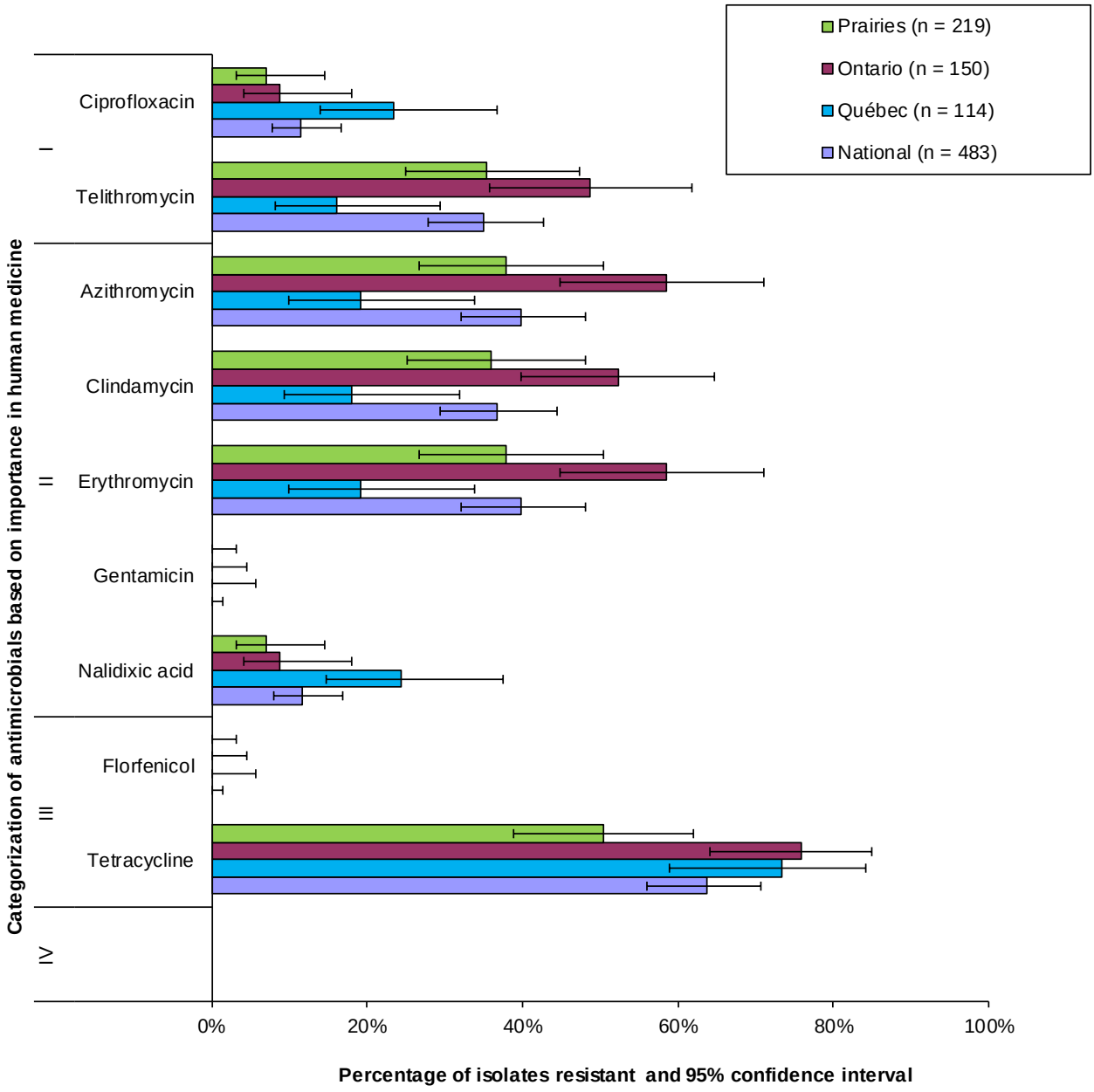
Province/region	Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	735	228	246	227	269	478	149	155	138	184	459	123	143	119	132
Antimicrobial															
Ampicillin	**27%**	22%	27%	**25%**	**23%**	**46%**	40%	41%	**36%**	**40%**	**35%**	34%	33%	**27%**	**25%**
Cefriaxone	**1%**	1%	1%	**0%**	**2%**	**2%**	2%	3%	**1%**	**1%**	**3%**	2%	4%	**0%**	**2%**
Gentamicin	**0%**	0%	0%	**0%**	**0%**	**4%**	2%	1%	**1%**	**2%**	**1%**	2%	3%	**5%**	**4%**
Nalidixic acid	**1%**	0%	0%	**0%**	**1%**	**0%**	0%	0%	**1%**	**1%**	**0%**	0%	0%	**0%**	**1%**
Streptomycin	**39%**	35%	36%	**33%**	**37%**	**47%**	48%	43%	**46%**	**52%**	**54%**	59%	50%	**60%**	**44%**
Tetracycline	**60%**	51%	58%	**50%**	**57%**	**85%**	78%	81%	**87%**	**78%**	**80%**	82%	79%	**84%**	**73%**
Trimethoprim-sulfamethoxazole	**8%**	7%	9%	**9%**	**6%**	**17%**	15%	10%	**14%**	**10%**	**18%**	20%	25%	**27%**	**28%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per herd.

For the temporal analyses within province/region, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years and the preceding surveillance year (grey areas). The presence of blue areas indicate significant differences ($P \leq 0.05$) for a given province/region and antimicrobial.

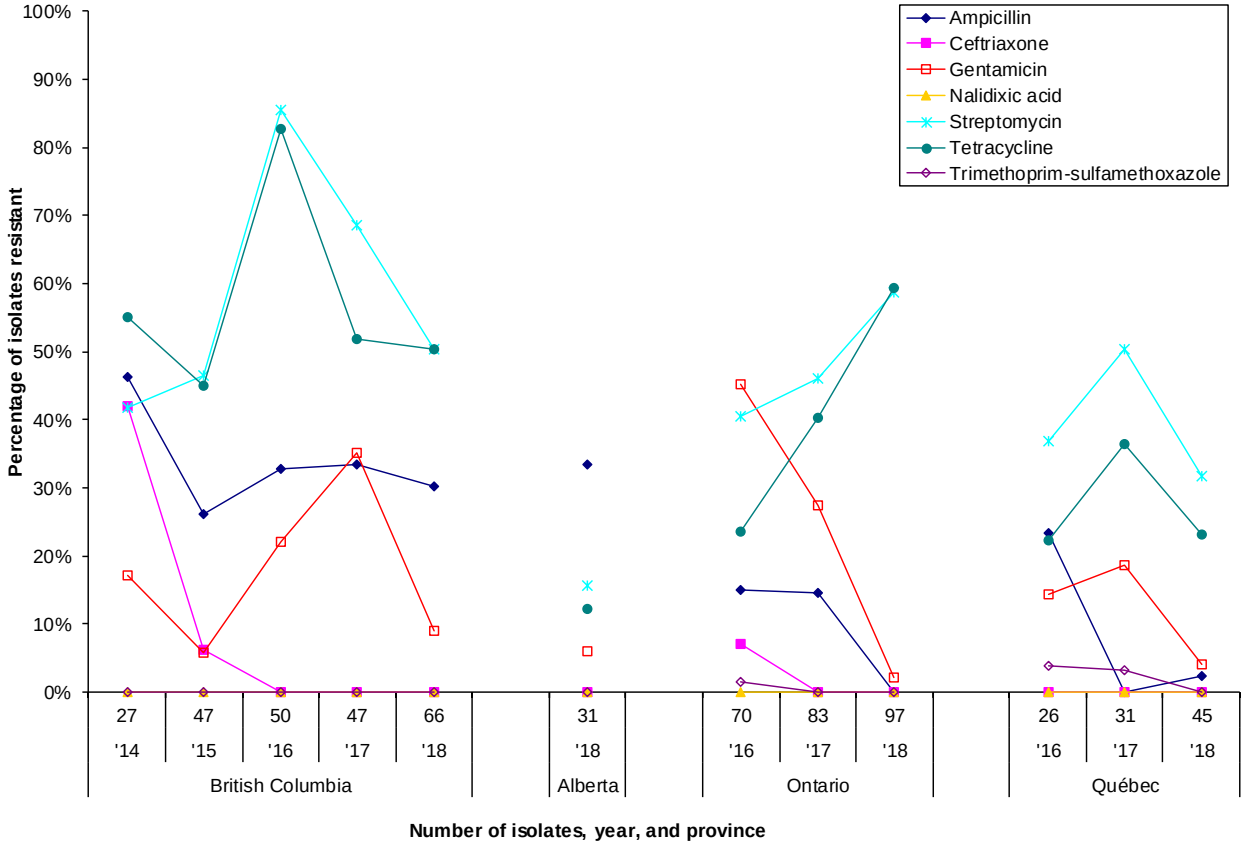
The Prairies region includes Alberta, Saskatchewan, and Manitoba.

Figure 3. 33 Resistance of *Campylobacter* isolates from pigs, 2018



The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

Figure 3. 34 Temporal variations in resistance of *Salmonella* isolates from turkeys at pre-harvest, 2014 to 2018

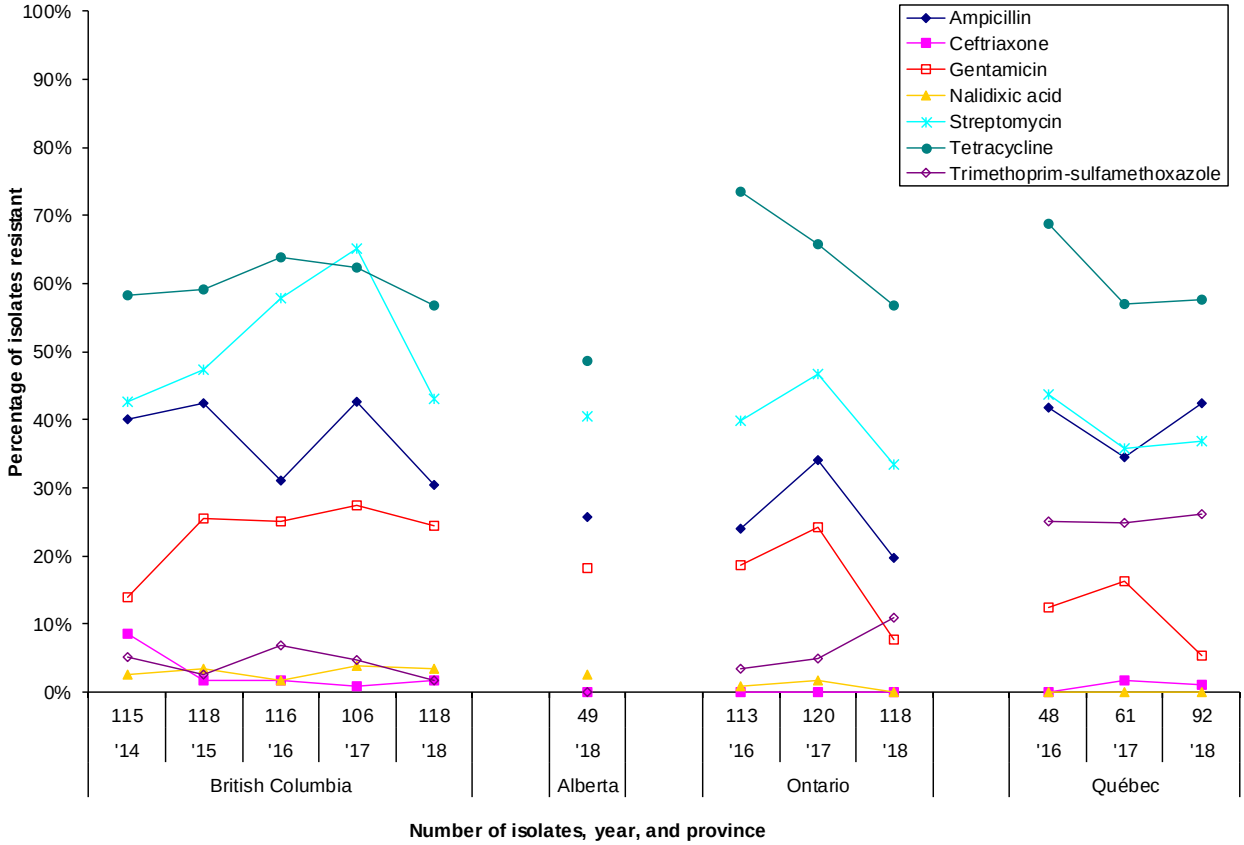


Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of isolates	27	47	50	47	66	31	70	83	97	26	31	45
Antimicrobial												
Ampicillin	**46%**	26%	33%	**33%**	**30%**	33%	**15%**	**15%**	**0%**	**23%**	**0%**	**2%**
Ceftriaxone	**42%**	6%	0%	**0%**	**0%**	0%	**7%**	**0%**	**0%**	**0%**	**0%**	**0%**
Gentamicin	**17%**	6%	22%	**35%**	**9%**	6%	**45%**	**27%**	**2%**	**14%**	**19%**	**4%**
Nalidixic acid	**0%**	0%	0%	**0%**	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Streptomycin	**42%**	47%	**86%**	**69%**	**50%**	16%	**41%**	**46%**	**59%**	**37%**	**50%**	**32%**
Tetracycline	**55%**	45%	**83%**	**52%**	**50%**	12%	**24%**	**40%**	**59%**	**22%**	**36%**	**23%**
Trimethoprim-sulfamethoxazole	**0%**	0%	0%	**0%**	**0%**	0%	**1%**	**0%**	**0%**	**4%**	**3%**	**0%**

For the temporal analyses by province, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the first surveillance year and the preceding surveillance year (grey areas). The presence of blue areas indicate significant differences ($P \leq 0.05$) for a given province and antimicrobial.

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

Figure 3. 35 Temporal variations in resistance of *Escherichia coli* isolates from turkeys at pre-harvest, 2014 to 2018

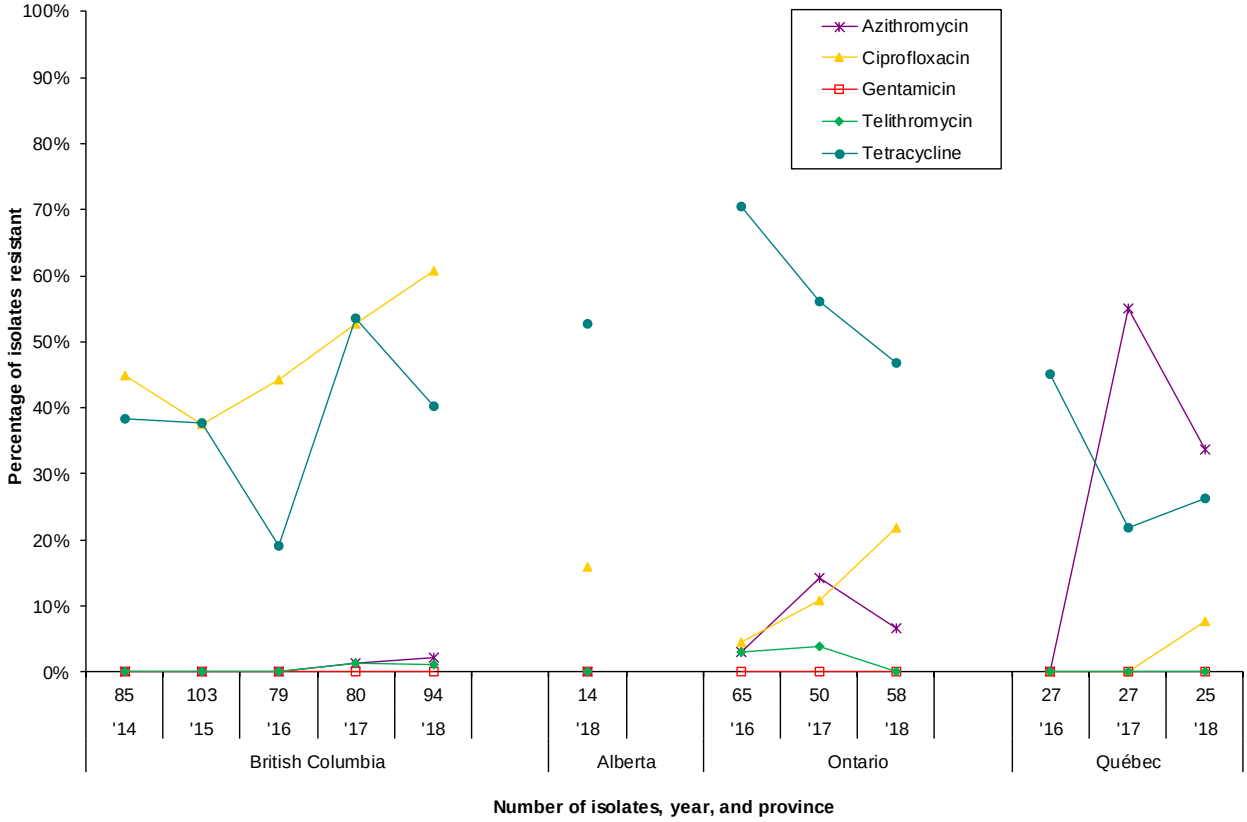


Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of isolates	115	118	116	106	118	49	113	120	118	48	61	92
Antimicrobial												
Ampicillin	40%	42%	31%	43%	30%	26%	24%	34%	20%	42%	35%	42%
Ceftriaxone	9%	2%	2%	1%	2%	0%	0%	0%	0%	0%	2%	1%
Gentamicin	14%	25%	25%	27%	25%	18%	19%	24%	8%	12%	16%	5%
Nalidixic acid	3%	3%	2%	4%	3%	3%	1%	2%	0%	0%	0%	0%
Streptomycin	43%	47%	58%	65%	43%	41%	40%	47%	33%	44%	36%	37%
Tetracycline	58%	59%	64%	62%	57%	49%	73%	66%	57%	69%	57%	58%
Trimethoprim-sulfamethoxazole	5%	3%	7%	5%	2%	0%	4%	5%	11%	25%	25%	26%

For the temporal analyses by province, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the first surveillance year and the preceding surveillance year (grey areas). The presence of blue areas indicate significant differences ($P \leq 0.05$) for a given province and antimicrobial.

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

Figure 3. 36 Temporal variations in resistance of *Campylobacter* isolates from turkeys at pre-harvest, 2014 to 2018



Province	British Columbia					Alberta	Ontario			Québec		
Year	'14	'15	'16	'17	'18	'18	'16	'17	'18	'16	'17	'18
Number of isolates	85	103	79	80	94	14	65	50	58	27	27	25
Antimicrobial												
Azithromycin	**0%**	0%	**0%**	**1%**	**2%**	0%	**3%**	**14%**	**7%**	**0%**	**55%**	**34%**
Ciprofloxacin	**45%**	37%	**44%**	**53%**	**61%**	16%	**5%**	**11%**	**22%**	**0%**	**0%**	**8%**
Gentamicin	**0%**	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Telithromycin	**0%**	0%	**0%**	**1%**	**1%**	0%	**3%**	**4%**	**0%**	**0%**	**0%**	**0%**
Tetracycline	**38%**	38%	**19%**	**54%**	**40%**	53%	**71%**	**56%**	**47%**	**45%**	**22%**	**26%**

For the temporal analyses by province, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the first surveillance year and the preceding surveillance year (grey areas). The presence of blue areas indicate significant differences ($P \leq 0.05$) for a given province and antimicrobial.

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

Recovery results

Table 3. 30 Farm Surveillance recovery rates in feedlot cattle, 2016 to 2018

Animal species	Province/region	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted							
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*	
Feedlot beef	Alberta	2016	**100%**	78/78	**4%**	3/78	**72%**	56/78		
		2017	**99%**	75/76	**1%**	1/76	**57%**	43/76		
		2018	**97%**	119/123	**2%**	2/123	**76%**	94/123		

Grey-shaded areas indicate either: a) isolates recovered from sampling activities outside the scope of CIPARS routine (or "core") surveillance in the specified year (i.e. grey-shaded areas with data) or b) discontinuation or no surveillance activity (i.e. grey-shaded areas with no data).

Table 3. 31 Farm Surveillance recovery rates in chickens, 2013 to 2018

CIPARS Component / Animal species	Province / region	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted							
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*	
Chickens	British Columbia	2013	**72%**	43/60	**28%**	17/60				
(Chick placement)		2014	**71%**	57/80	**23%**	18/80				
		2015	**74%**	37/50	**16%**	8/50				
		2016	**68%**	58/85	**12%**	10/85				
		2017	**84%**	59/70	**30%**	21/70				
		2018								
	Prairies	2013	**89%**	31/35	**29%**	10/35				
		2014	**82%**	46/56	**13%**	7/56				
		2015	**80%**	44/55	**20%**	11/55				
		2016	**73%**	40/55	**15%**	8/55				
		2017	**87%**	48/55	**22%**	12/55				
		2018								
	Ontario	2013	**85%**	64/75	**17%**	13/75				
		2014	**87%**	65/75	**3%**	2/75				
		2015	**88%**	66/75	**9%**	7/75				
		2016	**93%**	70/75	**3%**	2/75				
		2017	**87%**	65/75	**8%**	6/75				
		2018								
	Québec	2013	**82%**	53/65	**17%**	11/65				
		2014	**83%**	66/80	**11%**	9/80				
		2015	**87%**	39/45	**27%**	12/45				
		2016	**74%**	52/70	**21%**	15/70				
		2017	**76%**	65/85	**18%**	15/85				
		2018								
	National	2013	**81%**	191/235	**22%**	51/235				
		2014	**80%**	234/291	**12%**	36/291				
		2015	**83%**	186/225	**17%**	38/225				
		2016	**77%**	220/285	**12%**	35/285				
		2017	**83%**	237/285	**19%**	54/285				
		2018								

Grey-shaded areas indicate either: a) isolates recovered from sampling activities outside the scope of CIPARS routine (or "core") surveillance in the specified year (i.e. grey-shaded areas with data) or b) discontinuation or no surveillance activity (i.e. grey-shaded areas with no data).

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Table 3. 31 Farm Surveillance recovery rates in chickens, 2013 to 2018 (continued)

CIPARS Component / Animal species	Province / region	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted						
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*
Chickens (Pre-harvest)	British Columbia	2013	**98%**	94/96	**71%**	68/96	**28%**	27/96	
		2014	**100%**	116/116	**64%**	74/116	**22%**	26/116	
		2015	**97%**	97/100	**72%**	72/100	**25%**	25/100	
		2016	**100%**	128/128	**57%**	73/128	**24%**	31/128	
		2017	**98%**	117/120	**54%**	65/120	**37%**	44/120	
		2018	**100%**	120/120	**50%**	60/120	**38%**	46/120	
	Prairies	2013	**100%**	60/60	**40%**	24/60	**25%**	15/60	
		2014	**99%**	147/148	**36%**	54/148	**7%**	11/148	
		2015	**100%**	152/152	**55%**	84/152	**30%**	46/152	
		2016	**100%**	152/152	**43%**	66/152	**18%**	28/152	
		2017	**100%**	152/152	**48%**	73/152	**20%**	30/152	
		2018	**99%**	175/176	**59%**	103/176	**26%**	45/176	
	Ontario	2013	**100%**	120/120	**54%**	65/120	**17%**	20/120	
		2014	**99%**	166/168	**25%**	42/168	**21%**	35/168	
		2015	**99%**	195/196	**54%**	106/196	**18%**	36/196	
		2016	**99%**	159/160	**31%**	49/160	**16%**	26/160	
		2017	**99%**	154/156	**33%**	51/156	**23%**	36/156	
		2018	**92%**	144/156	**38%**	59/156	**10%**	15/156	
	Québec	2013	**99%**	111/112	**64%**	72/112	**17%**	19/112	
		2014	**100%**	132/132	**60%**	79/132	**16%**	21/132	
		2015	**99%**	95/96	**64%**	61/96	**10%**	10/96	
		2016	**100%**	104/104	**61%**	63/104	**8%**	8/104	
		2017	**97%**	116/120	**62%**	74/120	**10%**	12/120	
		2018	**100%**	108/108	**56%**	60/108	**15%**	16/108	
	National	2013	**99%**	385/388	**59%**	229/388	**20%**	81/388	
		2014	**99%**	561/564	**44%**	249/564	**16%**	93/564	
		2015	**99%**	539/544	**59%**	323/544	**22%**	117/544	
		2016	**99%**	543/544	**46%**	251/544	**17%**	93/544	
		2017	**98%**	539/548	**48%**	263/548	**22%**	122/548	
		2018	**98%**	547/560	**50%**	282/560	**22%**	122/560	

Grey-shaded areas indicate either: a) isolates recovered from sampling activities outside the scope of CIPARS routine (or "core") surveillance in the specified year (i.e. grey-shaded areas with data) or b) discontinuation or no surveillance activity (i.e. grey-shaded areas with no data).

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Table 3. 32 Farm Surveillance recovery rates in pigs, 2006 to 2018

Animal species	Province/region	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted							
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*	
Pigs	Prairies	2012	**100%**	232/232	**19%**	43/232				
		2013	**98%**	224/228	**14%**	33/228				
		2014	**99%**	248/252	**16%**	40/252				
		2015	**97%**	228/234	**18%**	43/234				
		2016	**98%**	246/252	**18%**	46/252				
		2017	**97%**	227/234	**20%**	46/234	**80%**	187/234		
		2018	**98%**	269/276	**18%**	49/276	**80%**	220/276		
	Ontario	2012	**99%**	167/168	**18%**	31/168				
		2013	**100%**	168/168	**26%**	43/168				
		2014	**100%**	162/162	**41%**	67/162				
		2015	**99%**	149/150	**29%**	43/150				
		2016	**99%**	155/156	**22%**	34/156				
		2017	**100%**	138/138	**19%**	26/138	**71%**	98/138		
		2018	**99%**	184/186	**26%**	49/186	**81%**	150/186		
	Québec	2012	**100%**	120/120	**16%**	19/120				
		2013	**100%**	138/138	**17%**	23/138				
		2014	**100%**	156/156	**26%**	40/156				
		2015	**98%**	123/126	**28%**	35/126				
		2016	**99%**	143/144	**21%**	30/144				
		2017	**99%**	119/120	**38%**	45/120	**70%**	84/120		
		2018	**100%**	132/132	**31%**	41/132	**86%**	114/132		
	National	2006	**99%**	459/462	**20%**	94/462			**81%**	374/462
		2007	**100%**	612/612	**21%**	136/612			**81%**	495/612
		2008	**99%**	481/486	**13%**	61/486			**92%**	448/486
		2009	**99%**	695/698	**18%**	124/698			**97%**	680/698
		2010	**99%**	566/569	**18%**	101/569			**96%**	545/569
		2011	**100%**	560/560	**14%**	77/560				
		2012	**99%**	519/520	**18%**	93/520				
		2013	**99%**	530/534	**19%**	99/534				
		2014	**99%**	566/570	**26%**	147/570				
		2015	**98%**	500/510	**24%**	121/510				
		2016	**99%**	544/552	**20%**	110/552				
		2017	**98%**	484/492	**24%**	117/492	**75%**	369/492		
		2018	**99%**	585/594	**23%**	139/594	**82%**	484/594		

Grey-shaded areas indicate either: a) isolates recovered from sampling activities outside the scope of CIPARS routine (or "core") surveillance in the specified year (i.e. grey-shaded areas with data) or b) discontinuation or no surveillance activity (i.e. grey-shaded areas with no data).

The Prairies is a region including the provinces of Alberta and Saskatchewan.

Table 3. 33 Farm Surveillance recovery rates in turkeys, 2016 to 2018

Animal species	Province / region	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted						
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*
Turkeys	British Columbia	2016	**100%**	116/116	**43%**	50/116	**68%**	79/116	
		2017	**98%**	106/108	**44%**	47/108	**75%**	80/108	
		2018	**99%**	118/119	**55%**	66/119	**79%**	94/119	
	Alberta	2018	**98%**	39/40	**78%**	31/40	**35%**	14/40	
	Ontario	2016	**97%**	113/116	**60%**	70/116	**56%**	65/116	
		2017	**100%**	120/120	**69%**	83/120	**42%**	50/120	
		2018	**98%**	118/120	**81%**	97/120	**48%**	58/120	
	Québec	2016	**100%**	48/48	**54%**	26/48	**56%**	27/48	
		2017	**95%**	61/64	**48%**	31/64	**42%**	27/64	
		2018	**100%**	92/92	**49%**	45/92	**27%**	25/92	
	National	2016	**99%**	277/280	**52%**	146/280	**61%**	171/280	
		2017	**98%**	287/292	**55%**	161/292	**54%**	157/292	
		2018	**99%**	367/371	**64%**	239/371	**51%**	191/371	

Grey-shaded areas indicate either: a) isolates recovered from sampling activities outside the scope of CIPARS routine (or "core") surveillance in the specified year (i.e. grey-shaded areas with data) or b) discontinuation or no surveillance activity (i.e. grey-shaded areas with no data).

Surveillance of Animal Clinical Isolates

Multiclass resistance

Table 3. 34 Number of antimicrobial classes in resistance patterns of *Salmonella* from cattle, 2018

Serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Dublin	77 (45.3)			1	25	51	2	77	72	72	72	72		77	5		76	1	54	77
Typhimurium	41 (24.1)	9		4	26	2		28	29	4	4	4		32	22	1	24		1	31
4,[5],12:i:-	9 (5.3)	3			6		1	6	6					6	2		2			6
Uganda	8 (4.7)			3		5	5	8	5	5	5	5		8	5	5	5			8
Cerro	5 (2.9)	5																		
Infantis	5 (2.9)	3			2		1	2	1	1	1	1		2			2			2
Less common serovars	25 (14.7)	18	1	1	1	4		4	6	6	6	6		6	2		5		4	6
Total	**170 (100)**	**38**	**1**	**9**	**60**	**62**	**9**	**125**	**119**	**88**	**88**	**88**		**131**	**36**	**6**	**114**	**1**	**59**	**130**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

Table 3. 35 Number of antimicrobial classes in resistance patterns of *Salmonella* from chickens, 2018

Serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Enteritidis	113 (50.2)	111	2																2	
Kentucky	27 (12.0)			27				27	8	8	8	8								27
Typhimurium	22 (9.8)	17	5					5												
Heidelberg	12 (5.3)	5	6	1			1	1	6					1						
Schwarzengrund	9 (4.0)	9																		
Infantis	7 (3.1)	7																		
Less common serovars	35 (15.6)	20	8	6	1			11	4	1	1	1		2						11
Total	**225 (100)**	**169**	**21**	**34**	**1**		**1**	**44**	**18**	**9**	**9**	**9**		**3**					**2**	**38**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

Table 3. 36 Number of antimicrobial classes in resistance patterns of *Salmonella* from pigs, 2018

Serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Typhimurium	78 (30.1)	13	5	10	49	1	7	53	59					60	16	1	50			57
Derby	40 (15.4)	2	5	12	21		1	32	22	1	1	1		32	1					36
4,[5],12:i:-	24 (9.3)			1	23		1	24	24	9	9	9		24			8			23
Infantis	21 (8.1)	19			2		1	2	1	1	1	1		2	2	1	2			2
Brandenburg	15 (5.8)	4	6	5			4	4	5	3	3	3		5	1					7
Ohio var.14+	10 (3.9)	2		1	7		2	7	4					8	5		7			8
Mbandaka	8 (3.1)	7			1			1						1			1			1
Ohio	7 (2.7)	4			3			3	2	2	2	2		3	3		3			3
4,[5],12:d:-	6 (2.3)			5	1			6	1					6	3					6
Mbandaka var. 14+	6 (2.3)	3		1	2			3						3					2	3
Schwarzengrund	6 (2.3)	2		3	1		1	4	1	1	1	1		4	1		1			4
Less common serovars	38 (14.7)	14	3	12	9		2	21	10	3	4	3		11	1	1			1	21
Total	**259 (100)**	**70**	**19**	**50**	**119**	**1**	**19**	**160**	**129**	**20**	**21**	**20**		**159**	**33**	**3**	**72**		**3**	**171**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

Table 3. 37 Number of antimicrobial classes in resistance patterns of *Salmonella* from horses, 2018

Serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Thompson	4 (44.4)	4																		
Barranquilla	1 (11.1)	1																		
Derby	1 (11.1)	1																		
Infantis	1 (11.1)	1																		
Newport	1 (11.1)	1																		
Typhimurium	1 (11.1)	1																		
Total	**9 (100)**	**9**																		

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

Table 3. 38 Number of antimicrobial classes in resistance patterns of *Salmonella* from turkeys, 2018

Serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Heidelberg	55 (28.9)	7	9	39			47	48						39						
Uganda	30 (15.8)	6		24			1	24						24						24
Schwarzengrund	23 (12.1)	21	2					1												1
Bredeney	14 (7.4)		8	6			14	9	1	1	1	1		1						5
Reading	14 (7.4)	7	2	2	3			5	6					4						4
Agona	13 (6.8)	10		1	2			2	3	2	2	2		2			2			3
Muenchen	5 (2.6)	3	1	1				1						1						2
Ouakam	5 (2.6)	1	2	2			4	4						2						
4,[5],12:-:-	4 (2.1)		3	1			3	4						1						
Montevideo	4 (2.1)			4			4	4	4											
Less common serovars	23 (12.1)	7	7	8	1		5	15	4					3	1	1			1	6
Total	**190 (100)**	**62**	**34**	**88**	**6**		**78**	**117**	**18**	**3**	**3**	**3**		**77**	**1**	**1**	**2**		**1**	**45**

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Serovars represented by less than 2% of isolates were classified as "Less common serovars".

Surveillance of Feed and Feed Ingredients

Multiclass resistance

Table 3. 39 Number of antimicrobial classes in resistance patterns of *Salmonella* from feed and feed ingredients, 2018

Serovar	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway inhibitors		Macrolides	Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	STR	AMP	AMC	CRO	FOX	MEM	SSS	SXT	AZM	CHL	CIP	NAL	TET
Infantis	7 (20.6)	6	1												1					
Schwarzengrund	4 (11.8)	4																		
Senftenberg	4 (11.8)	4																		
Ealing	3 (8.8)	3																		
Cubana	2 (5.9)	2																		
19:-:-	2 (5.9)	2																		
42:z4,z23:-	2 (5.9)	2																		
Idikan	2 (5.9)	2																		
Lille	2 (5.9)	2																		
Muenster var. 15+ 34+	2 (5.9)	2																		
Agona	1 (2.9)	1																		
Mbandaka var. 14+	1 (2.9)	1																		
Minnesota	1 (2.9)	1																		
Montevideo	1 (2.9)	1																		
Total	**34 (100)**	**33**	**1**												**1**					

Antimicrobial abbreviations are defined in the Appendix.

Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

Appendix

Abbreviations

Canadian provinces, territories, and regions

Provinces

BC British Columbia
AB Alberta
SK Saskatchewan
MB Manitoba
ON Ontario
QC Québec
NB New Brunswick
NS Nova Scotia
PE Prince Edward Island
NL Newfoundland and Labrador

Territories

YT Yukon
NT Northwest Territories
NU Nunavut

Regions[7]

Prairies: AB, SK, MB
Maritimes: NB, NS, PE
Atlantic[8]: NB, NS, PE, NL

Antimicrobials

AMC Amoxicillin-clavulanic acid
AMP Ampicillin
AZM Azithromycin
CHL Chloramphenicol
CIP Ciprofloxacin
CLI Clindamycin
CRO Ceftriaxone
ERY Erythromycin
FLR Florfenicol
FOX Cefoxitin
GEN Gentamicin
MEM Meropenem
NAL Nalidixic acid
SSS Sulfisoxazole
STR Streptomycin
SXT Trimethoprim-sulfamethoxazole
TEL Telithromycin
TET Tetracycline
TIO Ceftiofur

[7] In 2018, not all provinces are represented in each surveillance component for the Prairies and the Atlantic region.
[8] In 2018, no sampling occurred in the Atlantic region.

Other abbreviations

APP *Actinobacillus pleuropneumoniae*

IBV Infectious Bronchitis Virus

PCVAD Porcine Circovirus Associated Disease

PDAR Pig-days at risk

PED Porcine Epidemic Diarrhea

PRRS Porcine Reproductive and Respiratory Syndrome

TGE Transmissible gastroenteritis

VDD Veterinary Drugs Directorate, Health Canada