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2017

Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

Figures and Tables

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Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) 2017

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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)
- New Brunswick Enteric Reference Centre (Sameh El Bailey)
- 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 Alberta Agriculture and Forestry, 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 (Nancy DeWith and Erin Zabek)
- Government of Alberta, Agriculture and Forestry (Rashed Cassis)
- Saskatchewan Health, Saskatchewan (Paul Levett)
- Veterinary Services Branch Laboratory, Manitoba (Neil Pople)
- The Animal Health Laboratory, University of Guelph, Ontario (Durda Slavic)
- IDEXX Laboratories, Ontario (Hani Dick)
- Direction générale des laboratoires d'expertise du ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (Marie Nadeau)
- Laboratoire d'épidémiosurveillance animale du Québec (Olivia Labrecque)
- Provincial Veterinary Laboratory, Department of Agriculture, Fisheries, and Aquaculture, New Brunswick (Jim Goltz)
- Veterinary Pathology Laboratory, Nova Scotia (Grant J. Spearman)
- Diagnostic Services, Atlantic Veterinary College, Prince Edward Island (Jan Giles)
- Animal Health Laboratory, Department of Fisheries, Forestry and Agrifoods, Newfoundland and Labrador (Laura Rogers)

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 like to thank the University of Guelph (Scott McEwen) for the joint collaborations with multiple students who have assisted in the preparation of the population correction unit: Ashley Gagne, Victoria Wells, Sarah Garner, Angelina Bosman, and Daleen Loest. CIPARS would also like to thank Christian Klopfenstein and Brian Radke for their excellent review and 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.

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.

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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 2017

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 2017 data, we will be releasing 3 documents: 2017 Figures and Tables, which includes the traditional summarized information but little accompanying text; 2017 Design and Methods; and 2017 Integrated Findings. Details about the innovative communication processes will be discussed with all national stakeholders in the Fall of 2019.

Antimicrobial resistance

- For 2017, only a partial year of retail sampling was conducted in Ontario and the Prairies, and no sampling occurred in the Atlantic region.
- Recovery of *Campylobacter* spp. from retail ground turkey was stopped mid-2016 due to low prevalence; sampling did not continue in 2017.
- In 2017, shared 2017 FoodNet/CIPARS samples were sequenced using the MiSeq platform from Illumina®; predictive serotype was determined using SISTR (*Salmonella in silico* Typing Resource).
- For 2017, *Salmonella* Enteritidis, Heidelberg, and Typhimurium serovar isolates were phagetyped if sent prior to September 28th, 2017; all isolates submitted after this date were not phagetyped.

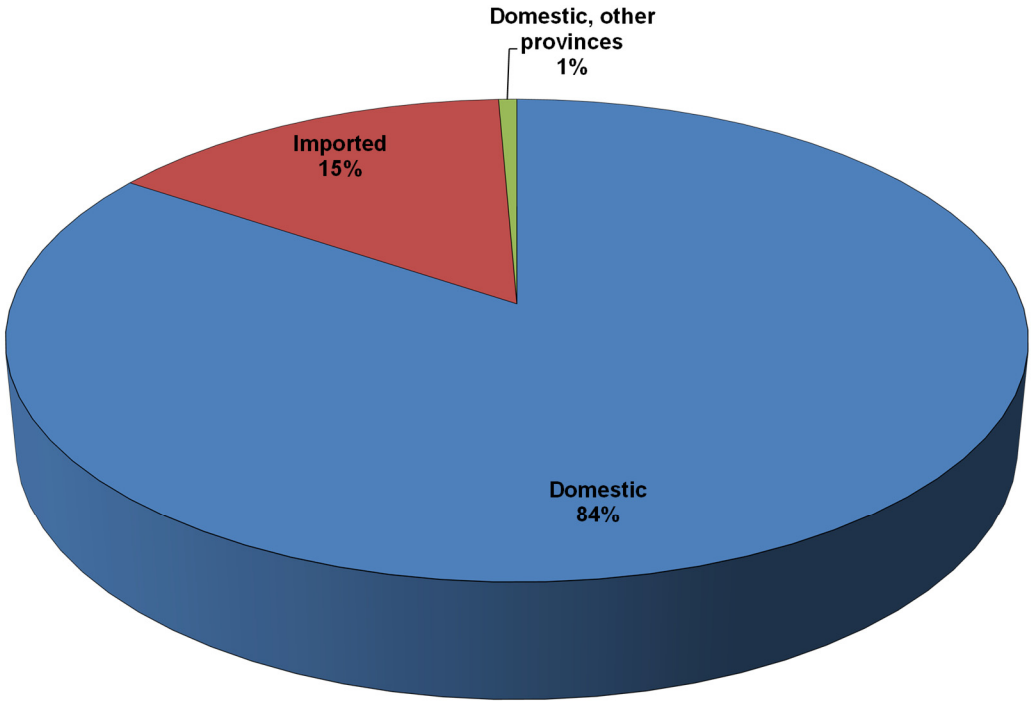
Antimicrobial use in animals

- In 2017, Fisheries and Oceans Canada provided quantities of antimicrobials used in marine and freshwater finfish aquaculture.

Chapter 1 Animal health status and farm information

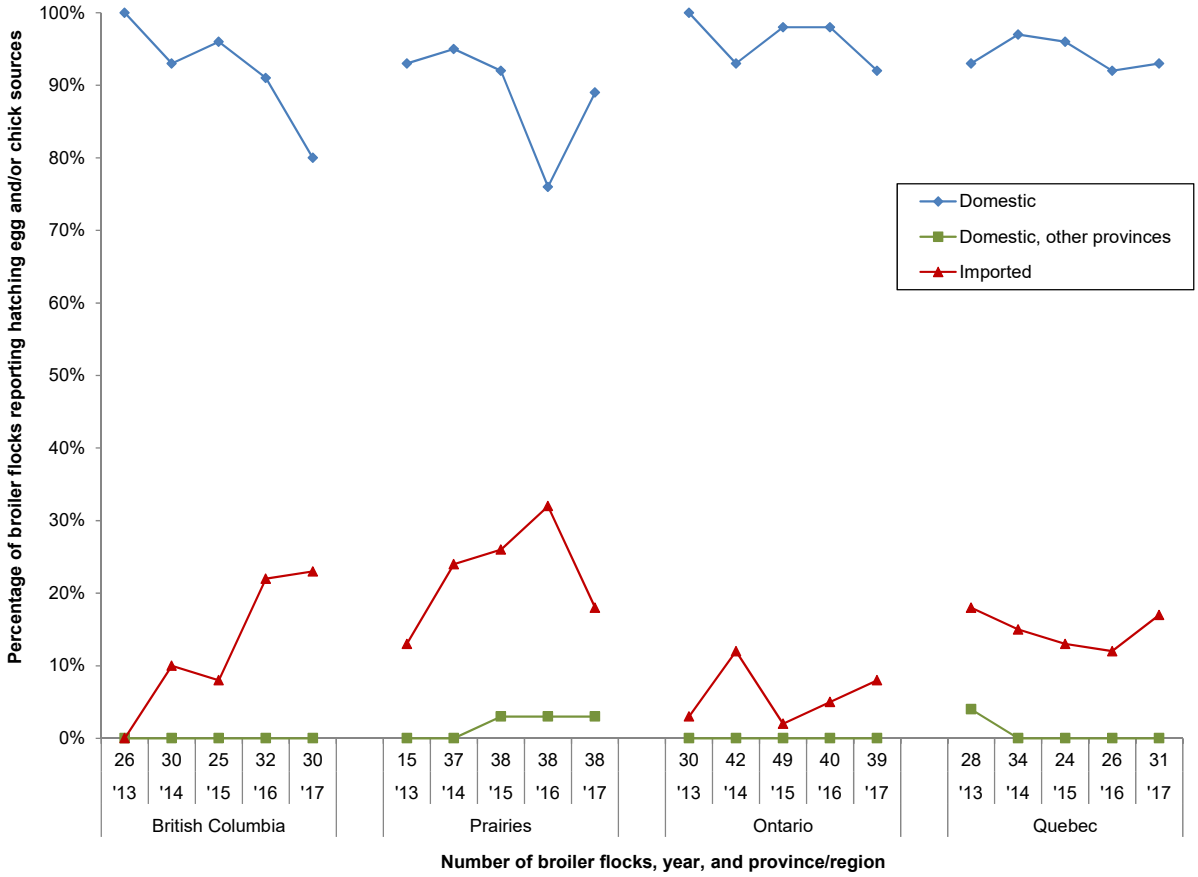
Broiler chickens

Figure 1. 1 Relative distribution of chick sources, 2017



Domestic chicks = 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, 2013 to 2017



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of flocks	26	30	25	32	30	15	37	38	38	38	30	42	49	40	39	28	34	24	26	31
Hatching egg and/or chick sources																				
Domestic	100%	93%	96%	91%	80%	93%	95%	92%	76%	89%	100%	93%	98%	98%	92%	93%	97%	96%	92%	93%
Domestic, other provinces	0%	0%	0%	0%	0%	0%	0%	3%	3%	3%	0%	0%	0%	0%	0%	4%	0%	0%	0%	0%
Imported	0%	10%	8%	22%	23%	13%	24%	26%	32%	18%	3%	12%	2%	5%	8%	18%	15%	13%	12%	17%

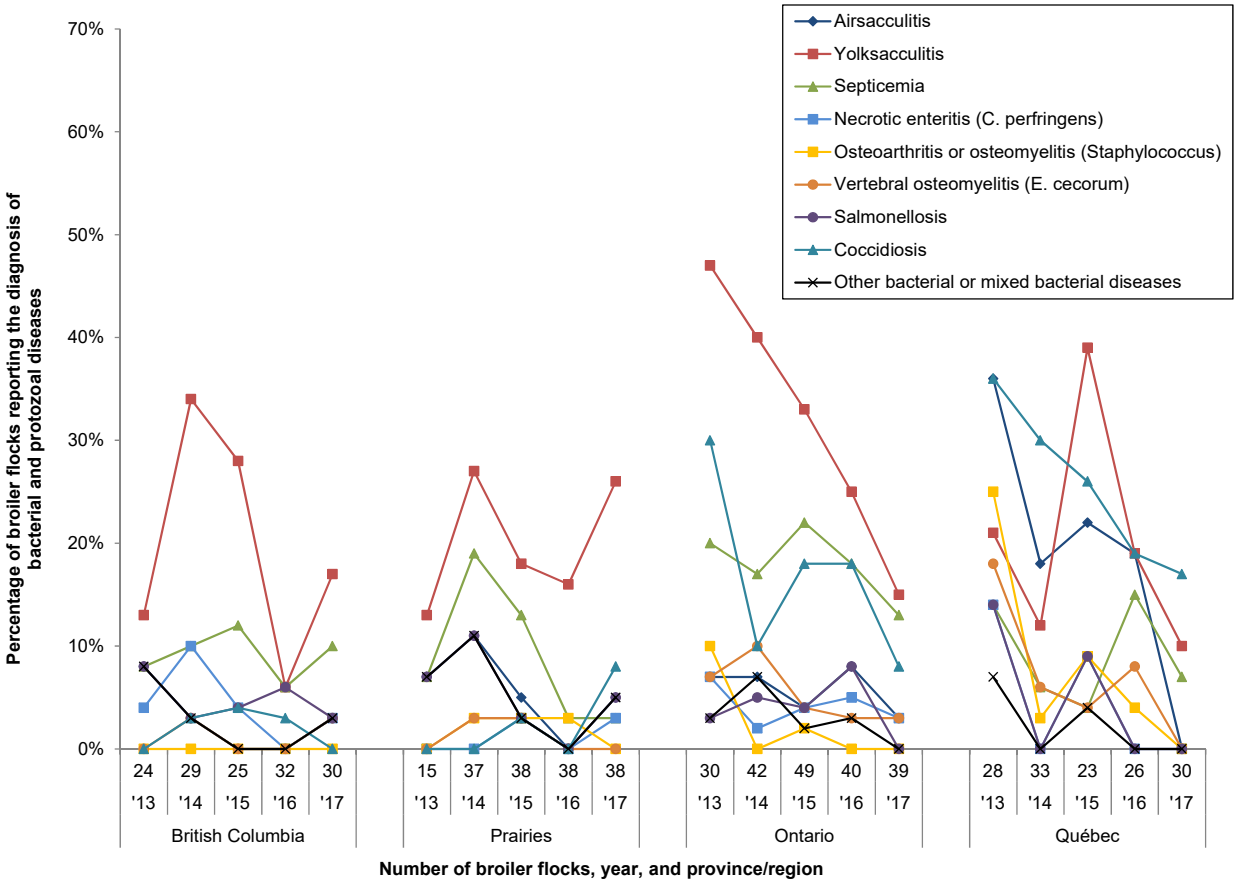
Domestic chicks = hatched from hatcheries located in the province where the birds were raised.

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, 2013 to 2017



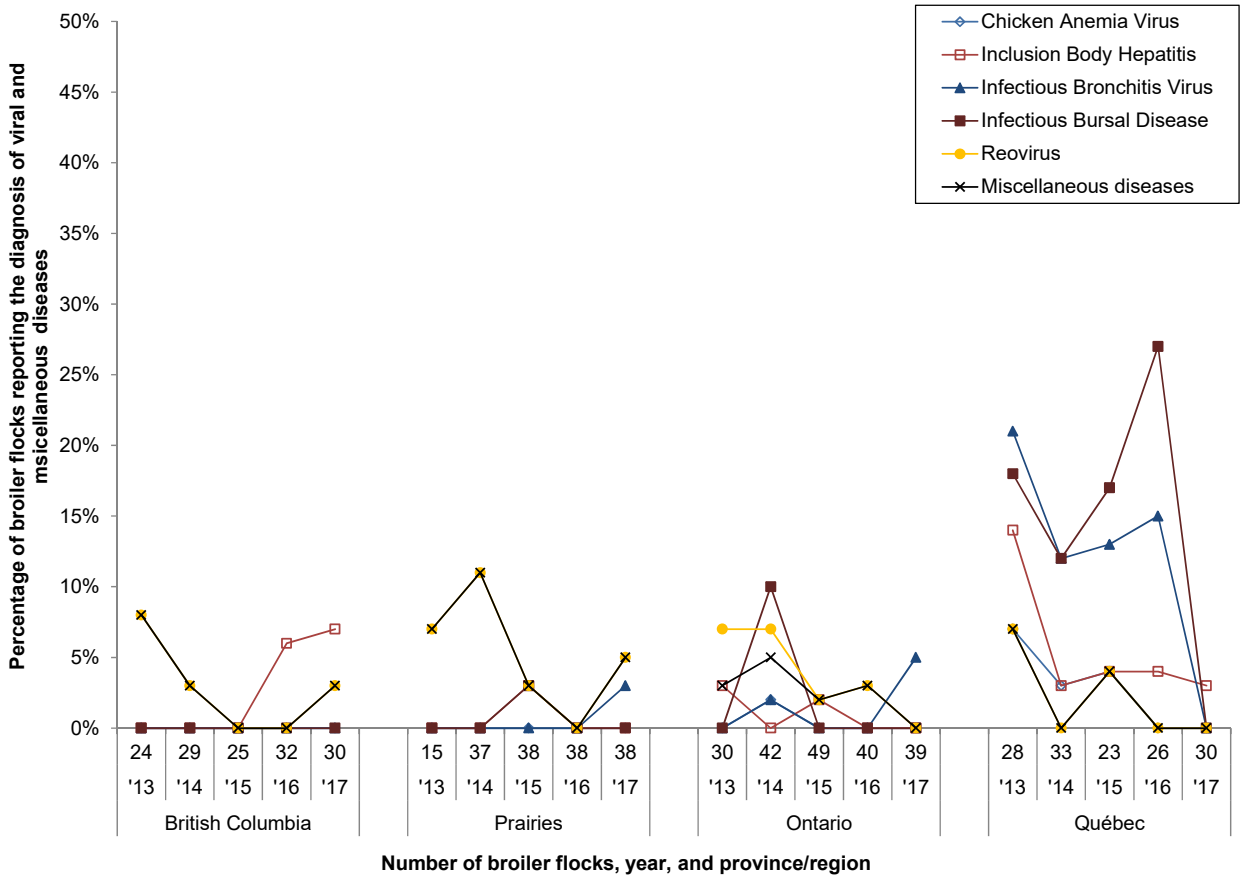
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks	24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Diseases																				
Airsacculitis	8%	3%	0%	0%	3%	7%	11%	5%	0%	5%	7%	7%	4%	8%	3%	36%	18%	22%	19%	0%
Yolksacculitis	13%	34%	28%	6%	17%	13%	27%	18%	16%	26%	47%	40%	33%	25%	15%	21%	12%	39%	19%	10%
Septicemia	8%	10%	12%	6%	10%	7%	19%	13%	3%	3%	20%	17%	22%	18%	13%	14%	6%	4%	15%	7%
Necrotic enteritis (*C. perfringens*)	4%	10%	4%	0%	3%	0%	0%	3%	0%	3%	7%	2%	4%	5%	3%	14%	0%	9%	0%	0%
Osteoarthritis or osteomyelitis (*Staphylococcus*)	0%	0%	0%	0%	0%	0%	3%	3%	3%	0%	10%	0%	2%	0%	0%	25%	3%	9%	4%	0%
Vertebral osteomyelitis (*E. cecorum*)	0%	3%	0%	0%	3%	0%	3%	3%	0%	0%	7%	10%	4%	3%	3%	18%	6%	4%	8%	0%
Salmonellosis	8%	3%	4%	6%	3%	7%	11%	3%	0%	5%	3%	5%	4%	8%	0%	14%	0%	9%	0%	0%
Coccidiosis	0%	3%	4%	3%	0%	0%	0%	3%	0%	8%	30%	10%	18%	18%	8%	36%	30%	26%	19%	17%
Other bacterial or mixed bacterial diseases	8%	3%	0%	0%	3%	7%	11%	3%	0%	5%	3%	7%	2%	3%	0%	7%	0%	4%	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 2017, other bacterial diseases reported were unspecified E. coli-associated disease syndromes.

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, 2013 to 2017



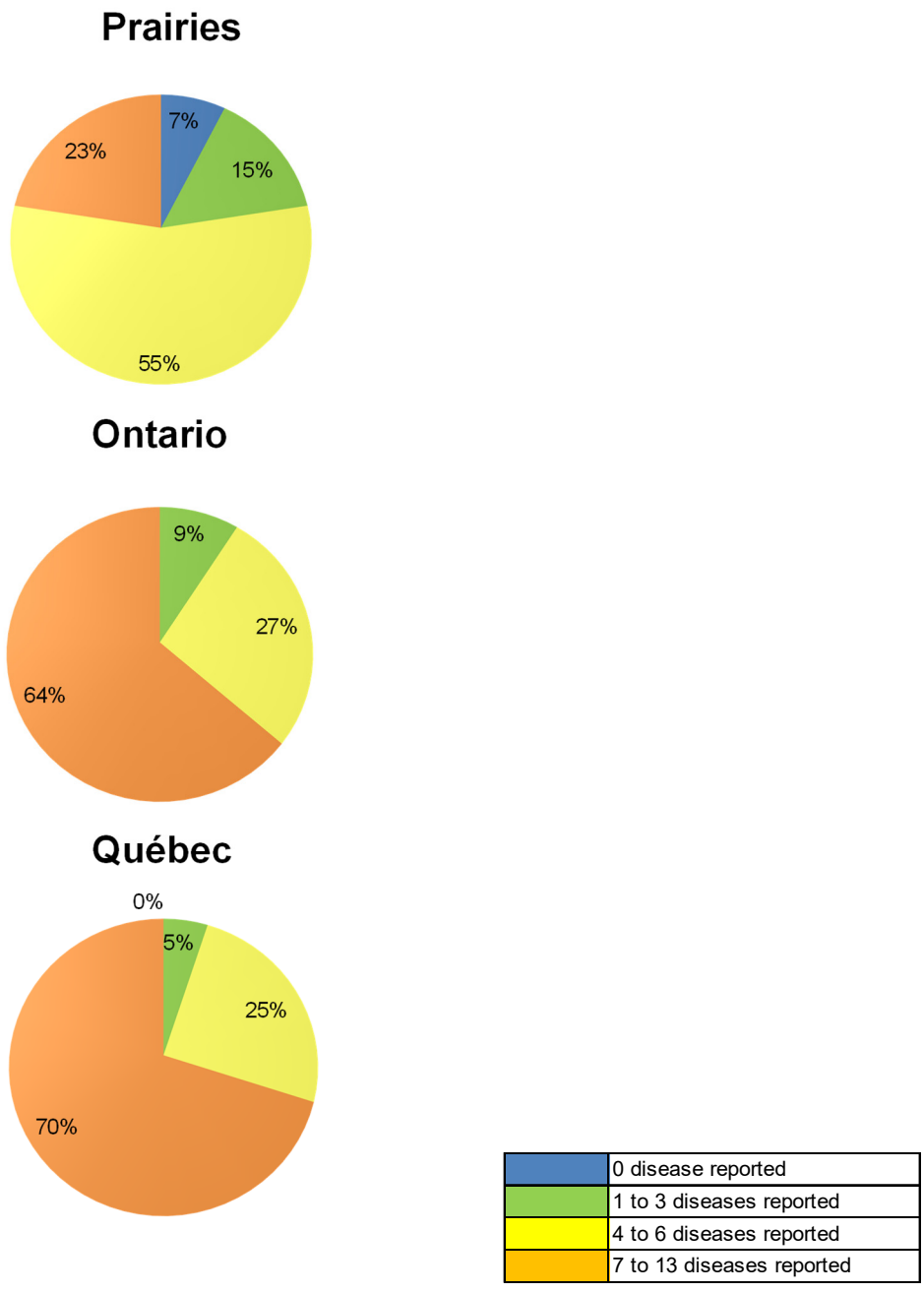
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks	24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Diseases																				
Chicken Anemia Virus	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	7%	3%	4%	0%	0%
Inclusion Body Hepatitis	0%	0%	0%	6%	7%	0%	0%	3%	0%	0%	3%	0%	2%	0%	0%	14%	3%	4%	4%	3%
Infectious Bronchitis Virus	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	0%	2%	0%	0%	5%	21%	12%	13%	15%	0%
Infectious Bursal Disease	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%	10%	0%	0%	0%	18%	12%	17%	27%	0%
Reovirus	8%	3%	0%	0%	3%	7%	11%	3%	0%	5%	7%	7%	2%	3%	0%	7%	0%	4%	0%	0%
Miscellaneous diseases	8%	3%	0%	0%	3%	7%	11%	3%	0%	5%	3%	5%	2%	3%	0%	7%	0%	4%	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 diagnoses were reported.

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 = 82) by province/region, 2017



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

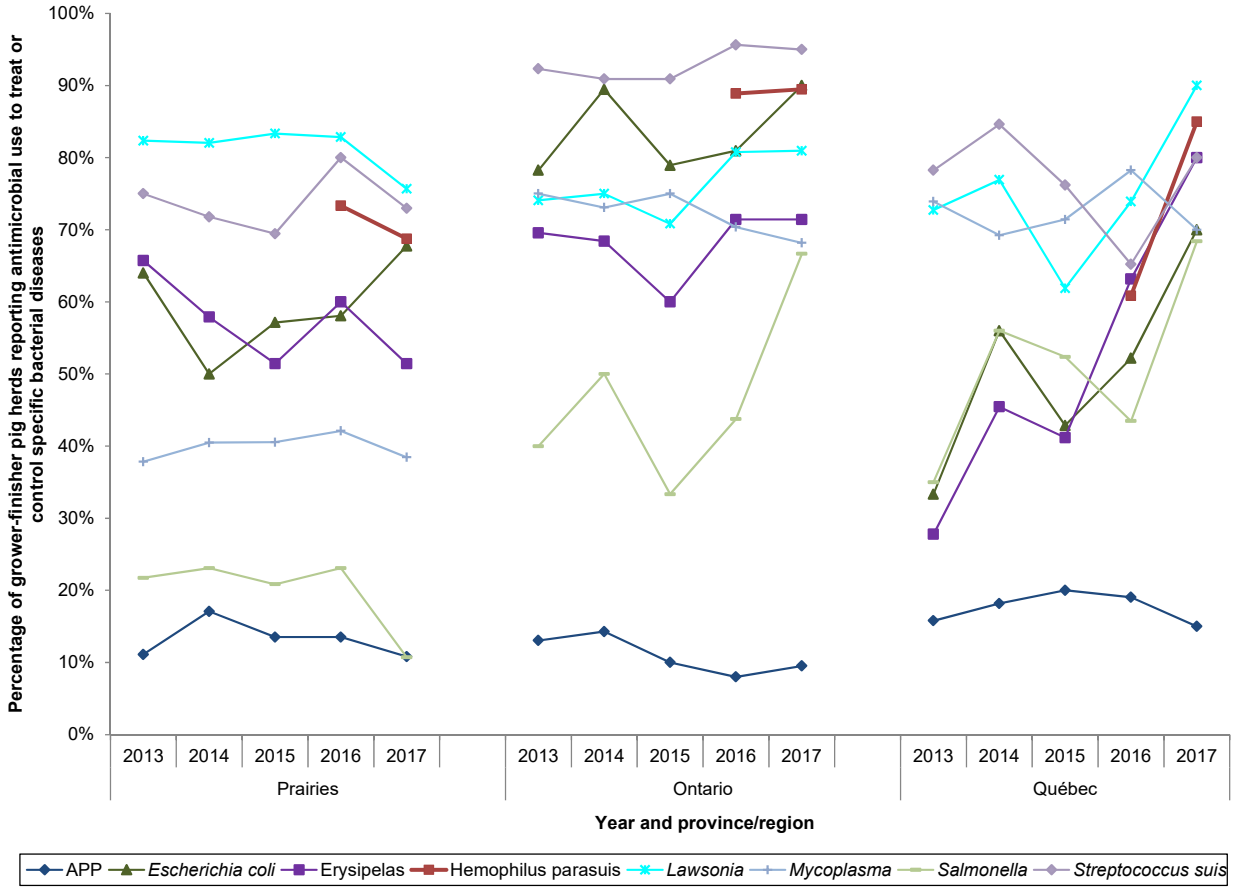
All farms in Ontario reported at least 1 disease on the questionnaire.

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, 2013 to 2017

a) Bacterial diseases



Province/region	Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Disease/bacteria															
APP	11%	17%	14%	14%	11%	13%	14%	10%	8%	10%	16%	18%	20%	19%	15%
Escherichia coli	64%	50%	57%	58%	68%	78%	89%	79%	81%	90%	33%	56%	43%	52%	70%
Erysipelas	66%	58%	51%	60%	51%	70%	68%	60%	71%	71%	28%	45%	41%	63%	80%
Hemophilus parasuis	NA	NA	NA	73%	69%	NA	NA	NA	89%	89%	NA	NA	NA	61%	85%
Lawsonia	82%	82%	83%	83%	76%	74%	75%	71%	81%	81%	73%	77%	62%	74%	90%
Mycoplasma	38%	40%	41%	42%	38%	75%	73%	75%	70%	68%	74%	69%	71%	78%	70%
Salmonella	22%	23%	21%	23%	11%	40%	50%	33%	44%	67%	35%	56%	52%	43%	68%
Streptococcus suis	75%	72%	69%	80%	73%	92%	91%	91%	96%	95%	78%	85%	76%	65%	80%

APP = *Actinobacillus pleuropneumoniae*.

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

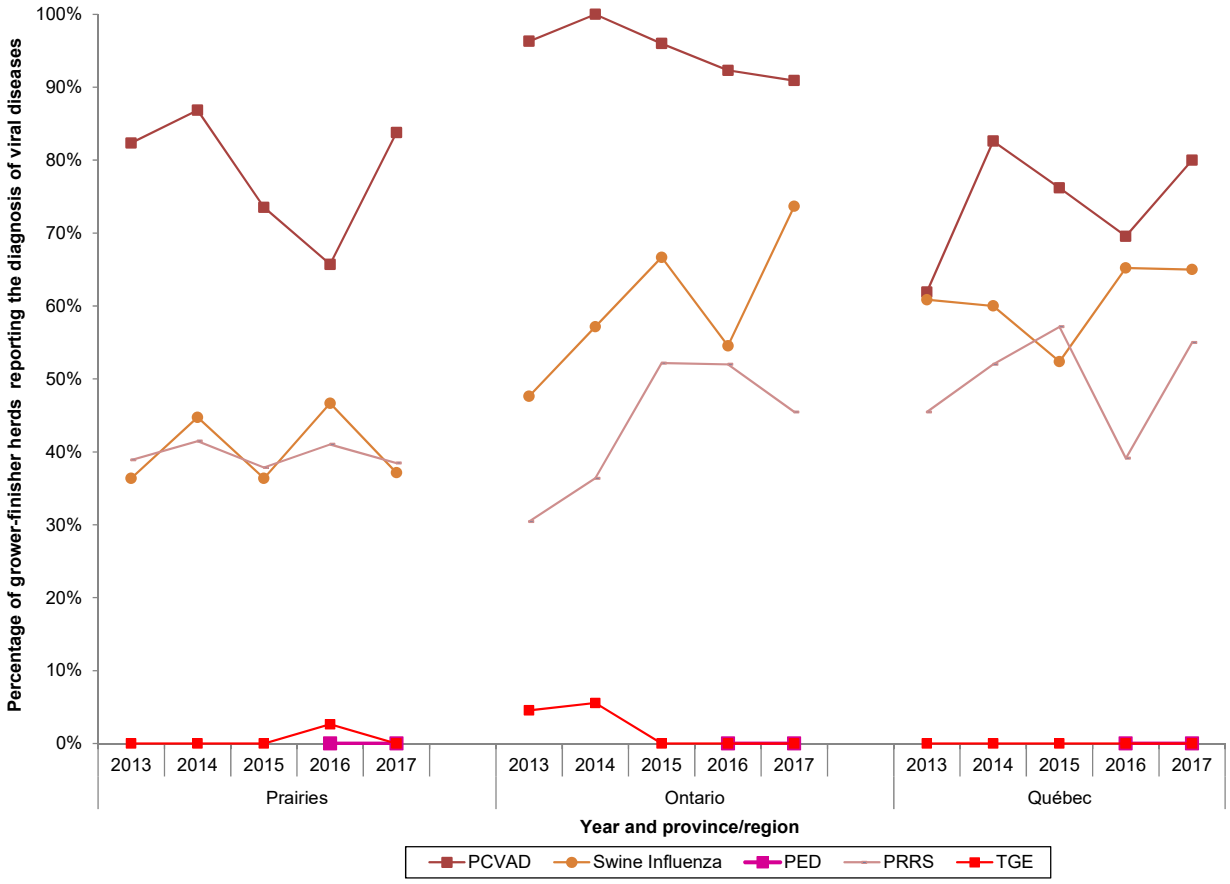
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

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, 2013 to 2017 (continued)

b) Viral diseases



Province/region	Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Disease/virus															
PCVAD	82%	87%	74%	66%	84%	96%	100%	96%	92%	91%	62%	83%	76%	70%	80%
Swine Influenza	36%	45%	36%	47%	37%	48%	57%	67%	55%	74%	61%	60%	52%	65%	65%
PED	NA	NA	NA	0%	0%	NA	NA	NA	0%	0%	NA	NA	NA	0%	0%
PRRS	39%	41%	38%	41%	38%	30%	36%	52%	52%	45%	45%	52%	57%	39%	55%
TGE	0%	0%	0%	3%	0%	5%	6%	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.

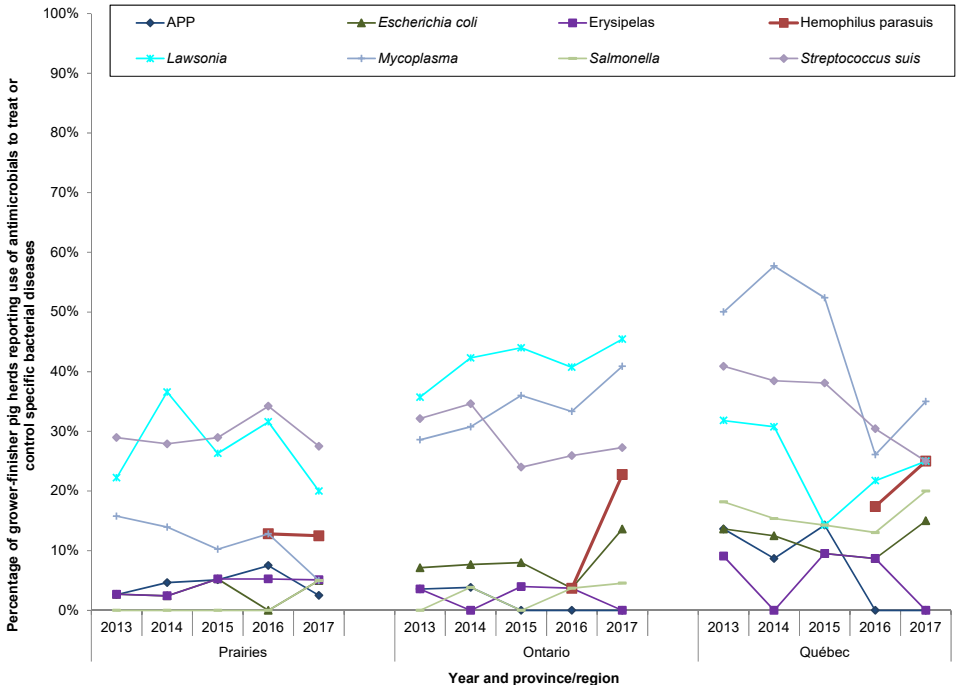
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

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

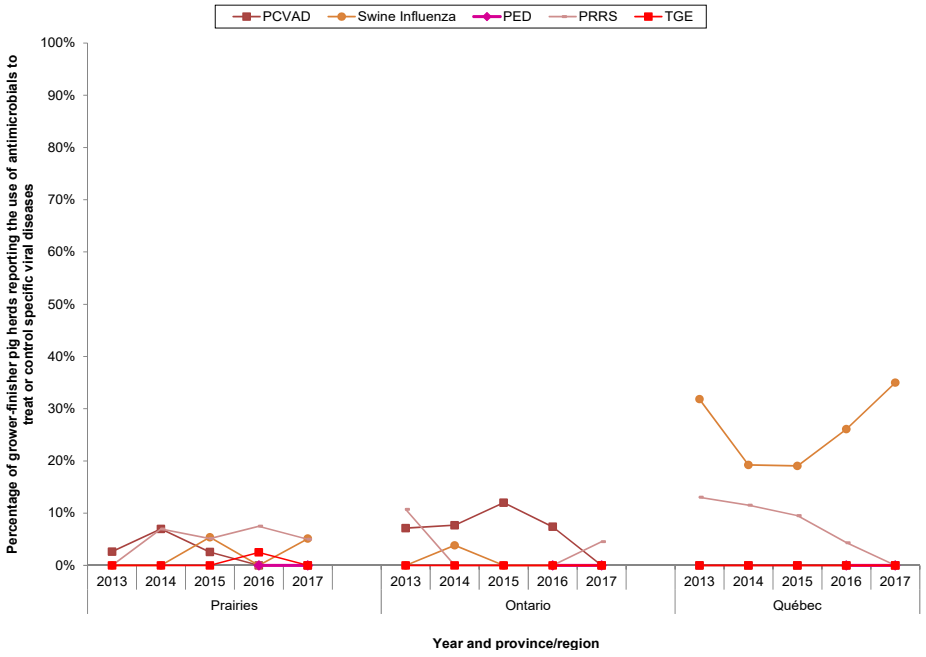
The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 1. 7 Reported antimicrobial use for specific diseases in grower-finisher pig herds by province/region, 2013 to 2017

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, 2013 to 2017 (continued)

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

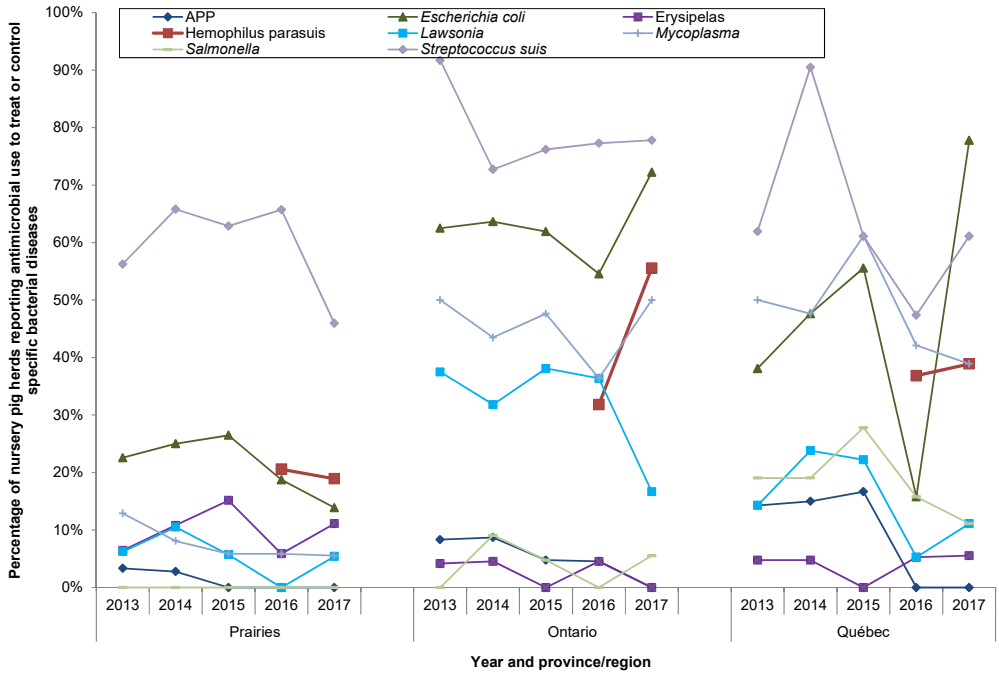
PCVAD = Porcine Circovirus Associated Disease. PED = Porcine Epidemic Diarrhea, added to the questionnaire in 2017. PRRS = Porcine Reproductive and Respiratory Syndrome. TGE = Transmissible Gastroenteritis.

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".

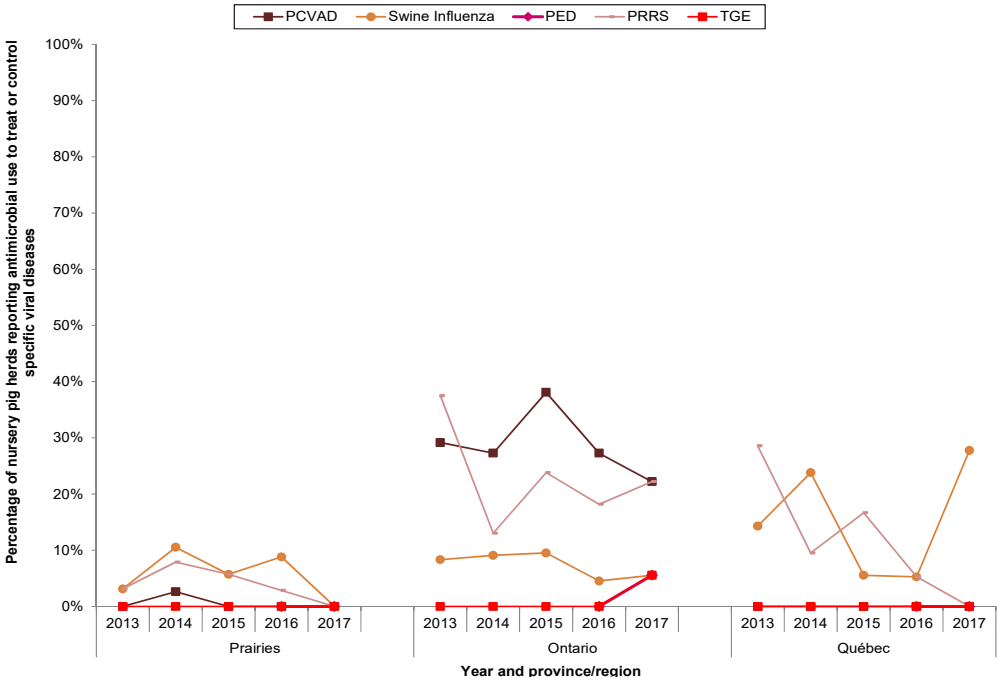
The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 1. 8 Reported antimicrobial use for specific diseases in nurseries supplying grower-finisher herds by province/region, 2013 to 2017

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, 2013 to 2017 (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 2017. PRRS = Porcine Reproductive and Respiratory Syndrome. TGE = Transmissible Gastroenteritis.

Not all questionnaires were completed for all diseases listed.

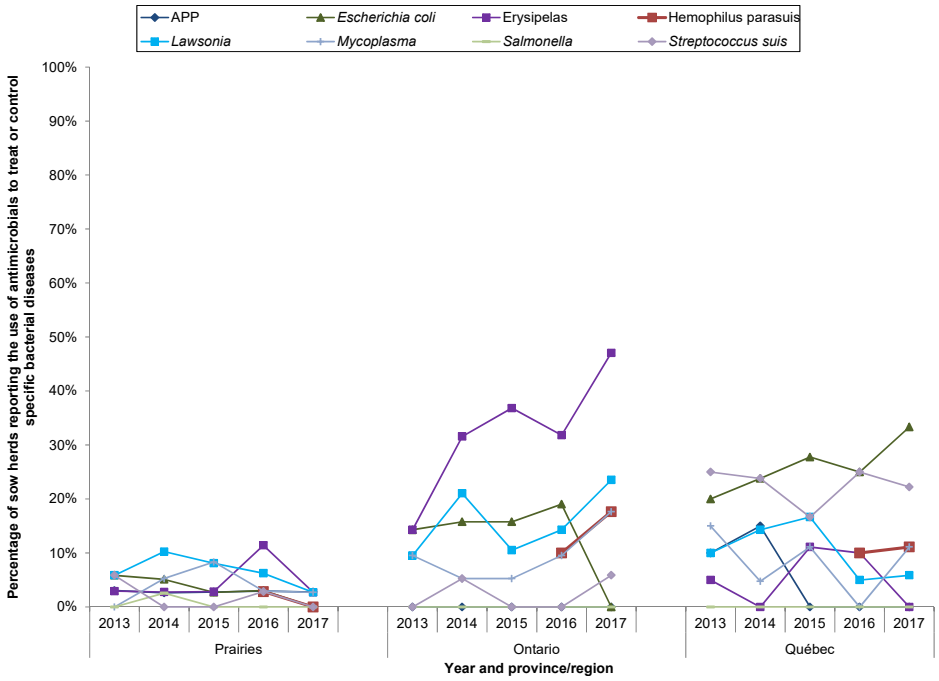
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

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.

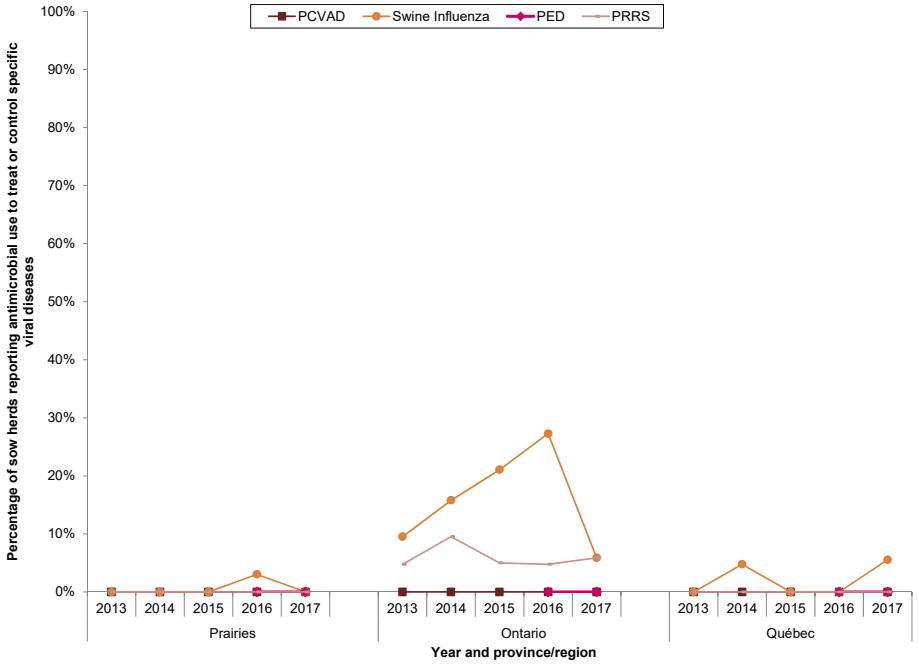
The Prairies is a region including the provinces of Alberta, Saskatchewan, and Manitoba.

Figure 1. 9 Reported antimicrobial use for specific diseases in sow herds supplying grower-finisher pig herds by province/region, 2013 to 2017

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, 2013 to 2017 (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.

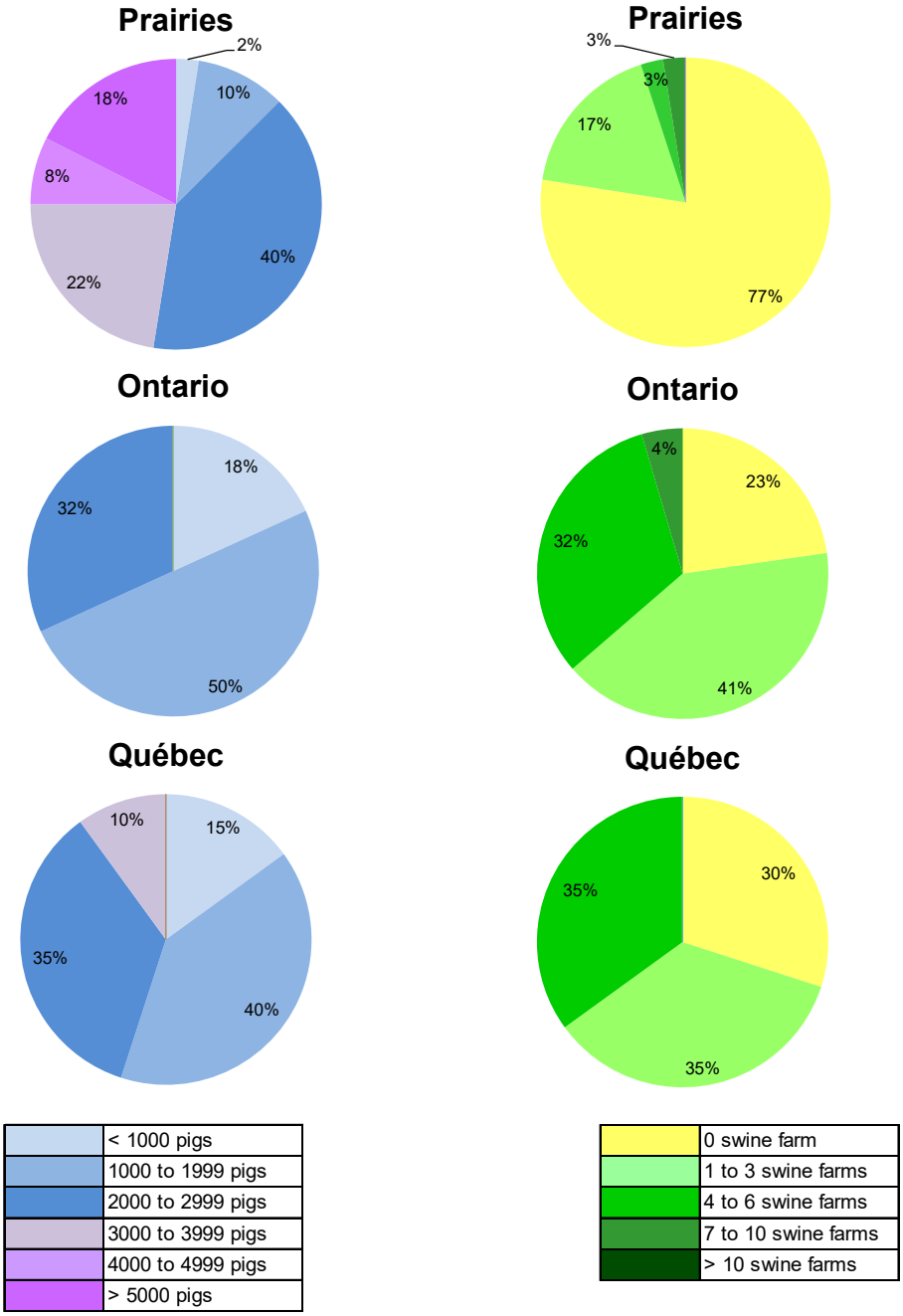
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

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 = 82), 2017

a) Barn Capacity



b) Number of swine farms within 2 km

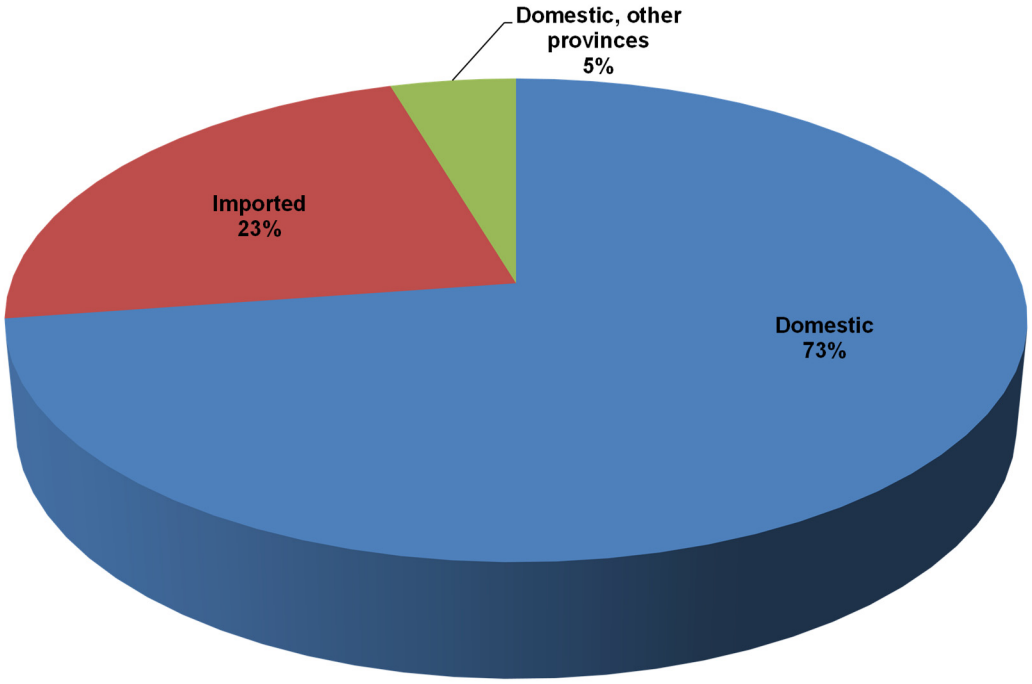
Capacity indicates the maximum number of pigs that the barn is designed to house.

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, 2017



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.

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, 2008 to 2017

Antimicrobial class aggregation	Quantity of active ingredient (kg)										Change (%) from 2008 to 2017	Change (%) from 2016 to 2017
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017		
Aminoglycosides											NA	NA
Aminoglycosides	5,817	4,652	3,961								NA	NA
Aminoglycosides				12,242	10,372	10,785					NA	NA
Aminoglycosides							13,276	13,718	13,213	11,477	NA	-13%
Amphenicols	3,242	4,001	4,391								NA	NA
β-Lactams (penicillins)											NA	NA
β-Lactams (penicillins)	109,153	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	NA	NA
Cephalosporins	NA	NA	NA								NA	NA
Cephalosporins				6,716	6,388	2,403	6,812	6,795	6,581	6,795	NA	3%
Fluoroquinolones	411	377	381	519	406	469	782	860	575	640	55%	11%
Lincosamides	41,222	44,137	46,373	43,256	51,027	54,784	60,006	65,646	48,052	50,225	22%	5%
Macrolides and pleuromutilins											NA	NA
Macrolides, pleuromutilins, and bacitracins	210,869	204,169	170,154								NA	NA
Macrolides	NA	NA	NA	108,858	98,622	93,870	112,340	114,186	96,653		NA	NA
Macrolides										89,986	NA	NA
Other antimicrobials											NA	NA
Other antimicrobials	32,706	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	NA	NA
Tetracyclines	680,601	686,832	535,142	600,918	635,435	635,675	599,540	659,784	596,823		NA	NA
Tetracyclines										501,582	NA	NA
Trimethoprim and sulfonamides	59,166	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	NA	NA
Total	**1,143,187**	**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**	**-17%**	**-11%**

See corresponding footnotes on next pages.

Table 2. 1 Quantity of antimicrobials (kg) distributed in Canada for sale for use in animals, 2008 to 2017 (continued)

NA = not available or not applicable.

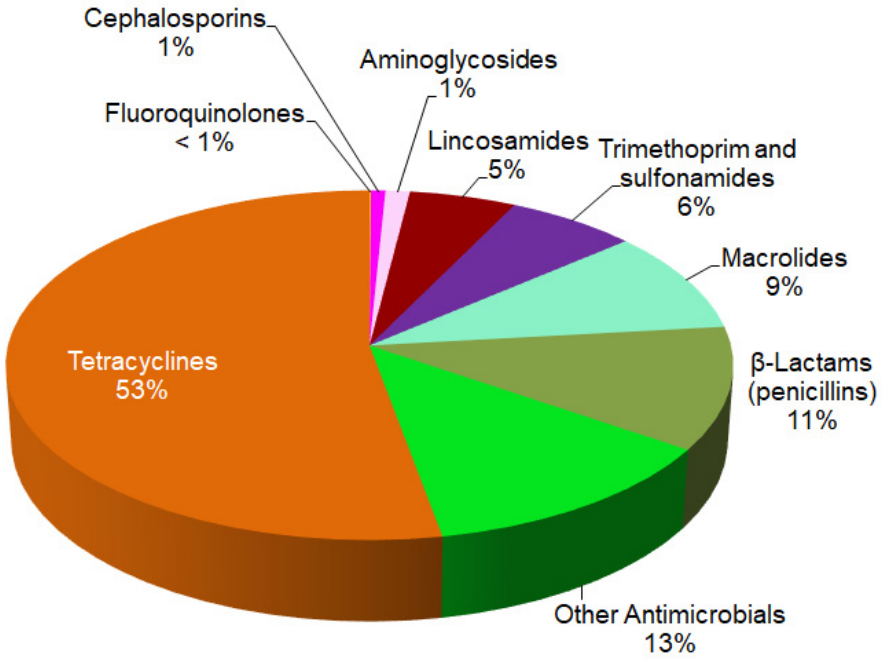
Changes in percentage over time from 2008 to 2017 are relative to the quantities reported in 2008. Changes in percentage over time from 2016 to 2017 are relative to the quantities reported in 2016.

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 2017 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, 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.

"Other antimicrobials" for 2017 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, 2016 to 2017

Year	Province	Aminoglycosides	β-Lactams (penicillins)	Cephalosporins	Fluoroquinolones	Lincosamides	Macrolides	Other antimicrobials	Tetracyclines	Trimethoprim and sulfonamides	Total
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**
2016	BC	1,396	5,167	909	62	97	613	15,302	30,073	2,029	55,647
	AB	710	9,973	1,075	167	5,971	34,050	16,577	107,734	9,869	186,126
	SK	520	2,328	264	8	3,385	2,810	4,171	20,811	3,474	37,769
	MB	1,826	19,706	321	25	7,083	15,165	8,325	62,745	6,462	121,658
	ON	4,293	50,128	2,210	237	15,512	23,759	35,296	199,696	29,804	360,937
	QC	4,230	22,012	1,420	62	15,983	19,803	39,571	171,224	16,027	290,331
	NS	128	566	172	7	9	409	1,199	3,812	229	6,532
	NB	32	421	111	4	7	15	357	374	711	2,031
	PE	9	338	39	1	1	24	41	317	198	969
	NL	70	167	60	2	3	5	795	39	74	1,214
Total		**13,213**	**110,806**	**6,581**	**575**	**48,052**	**96,653**	**121,634**	**596,823**	**68,878**	**1,063,215**

Province abbreviations are defined in the Appendix.

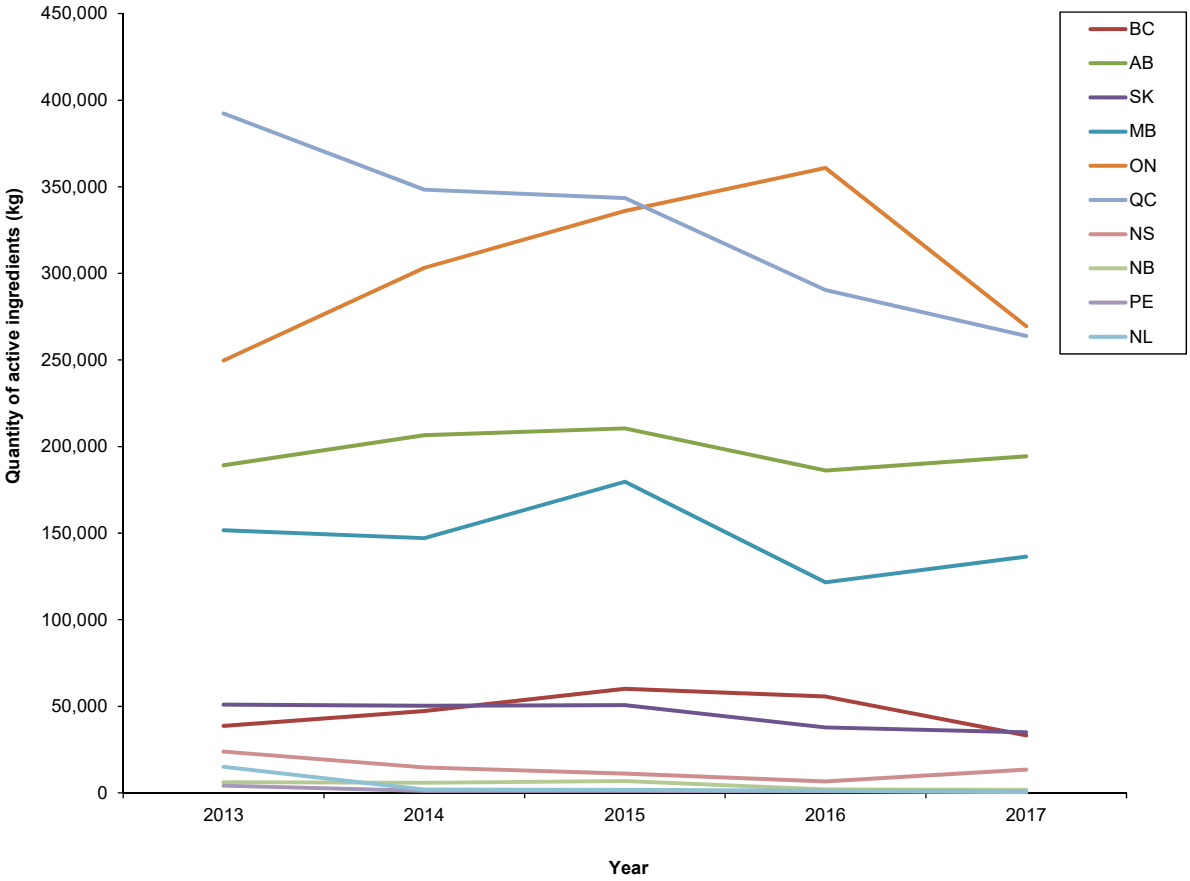
CAHI accounting rules can result in changes in changes of antimicrobial categorizations over time. Please consult Chapter 5: Design and methods of the CIPARS 2016 Annual Report to determine whether an appropriate comparison across years can be made for that antimicrobial class.

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 2017 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, 2013 to 2017



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, 2017

Animal type / province	Aminoglycosides	β-Lactams (penicillins)	Cephalosporins	Fluoroquinolones	Lincosamides	Macrolides	Other antimicrobials	Tetracyclines	Trimethoprim and sulfonamides	Total
Production animal										
BC	1,067	6,110	149	33	39	442	14,002	7,756	1,773	31,371
AB	809	10,989	446	159	6,641	36,284	18,050	109,575	9,836	192,789
SK	341	2,720	106	10	1,856	3,125	4,047	19,689	2,751	34,646
MB	1,487	19,704	201	18	8,393	11,878	10,848	76,825	6,453	135,808
ON	3,503	37,887	538	191	15,917	20,030	37,614	126,473	21,491	263,643
QC	4,156	24,830	590	38	17,102	18,000	32,975	149,515	14,103	261,310
NS	53	417	27	2	8	200	1,114	10,967	263	13,050
NB	28	391	18	0	3	12	95	437	474	1,459
PE	5	196	17	1	2	10	58	180	98	568
NL	12	91	11	0	1	4	59	19	32	228
Total	**11,461**	**103,335**	**2,103**	**454**	**49,962**	**89,986**	**118,863**	**501,435**	**57,273**	**934,873**
Companion animal										
BC	2	671	759	30	62	0	20	14	325	1,882
AB	2	554	566	22	43	0	10	13	332	1,541
SK	1	134	139	3	7	0	4	2	47	336
MB	1	155	124	6	8	0	3	6	327	630
ON	6	1,643	1,865	84	105	0	31	73	2,056	5,862
QC	3	743	899	30	26	0	31	26	811	2,569
NS	1	133	166	5	6	0	5	9	88	413
NB	1	109	102	3	4	0	3	3	69	294
PE	0	16	21	1	0	0	1	0	63	102
NL	0	55	51	2	2	0	2	1	1	114
Total	**16**	**4,212**	**4,692**	**186**	**262**	**0**	**108**	**147**	**4,119**	**13,743**
Total (animal types combined)	**11,477**	**107,548**	**6,795**	**640**	**50,225**	**89,986**	**118,971**	**501,582**	**61,392**	**948,616**

Production animals include horses.

Province abbreviations are defined in the Appendix.

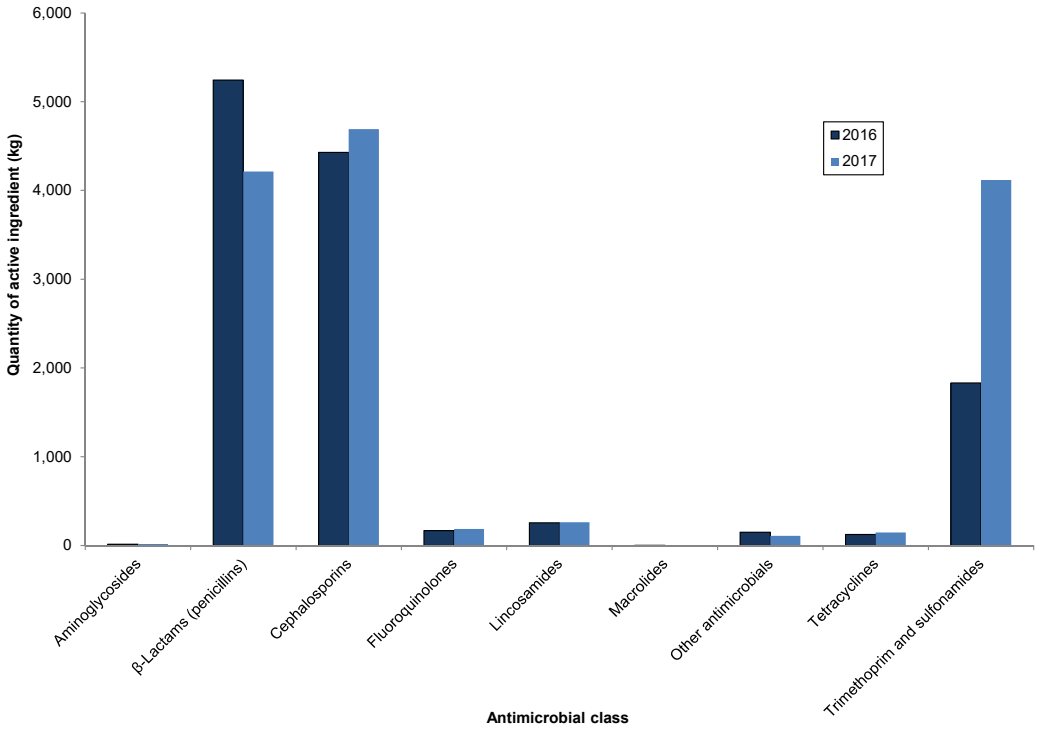
The attribution of antimicrobials sold in each province to the type of animal (companion animals vs. production animals) was based on multiplying a national average percentage of the antimicrobial sold for companion animals/production animals by the total quantities reported for that province by the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

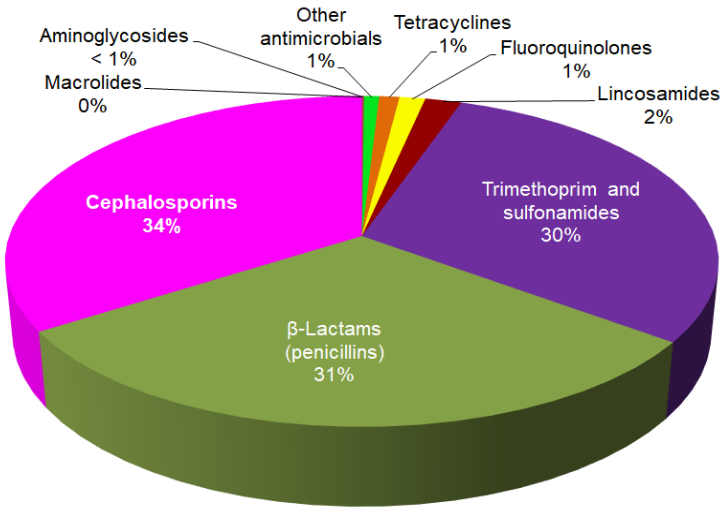
"Other antimicrobials" for 2017 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

Figure 2. 3 Quantity of antimicrobials (kg of active ingredient) distributed for sale for use in companion animals over time and in 2017

a) Over time



a) 2017



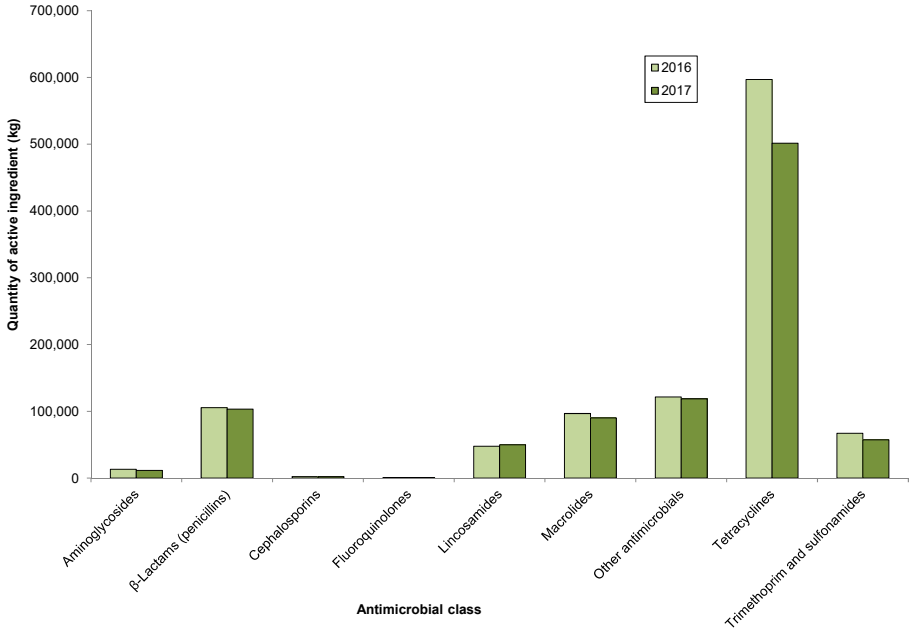
Antimicrobial sales were assigned to animal type according to label claim and in the situation where mixed species was indicated on the label, the manufacturer assigned the kg to either "Companion animal" or "Production animal".

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.

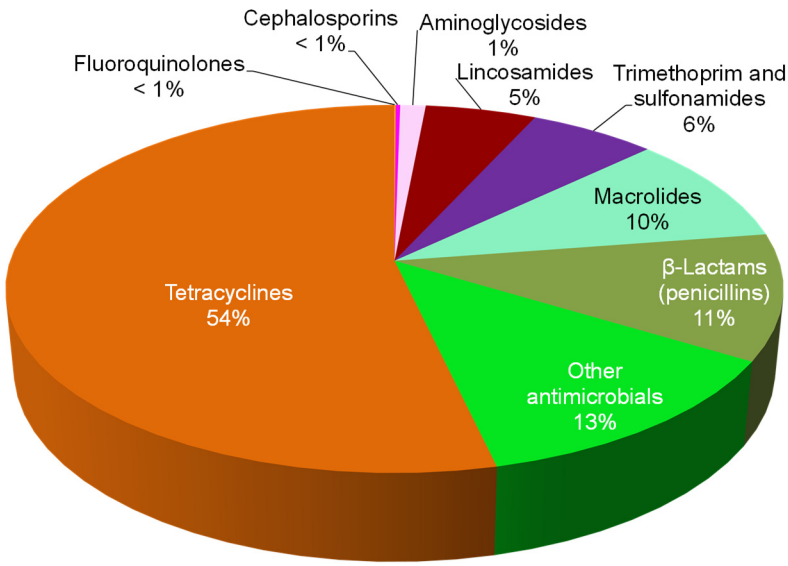
"Other antimicrobials" for 2017 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

Figure 2. 4 Quantity of antimicrobials (kg of active ingredient) distributed for sale for use in production animals over time and in 2017

a) Over time



b) 2017



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".

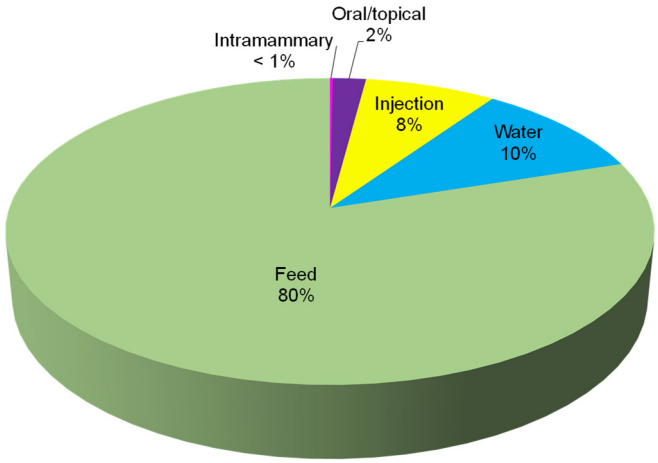
Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

"Other antimicrobials" for 2017 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

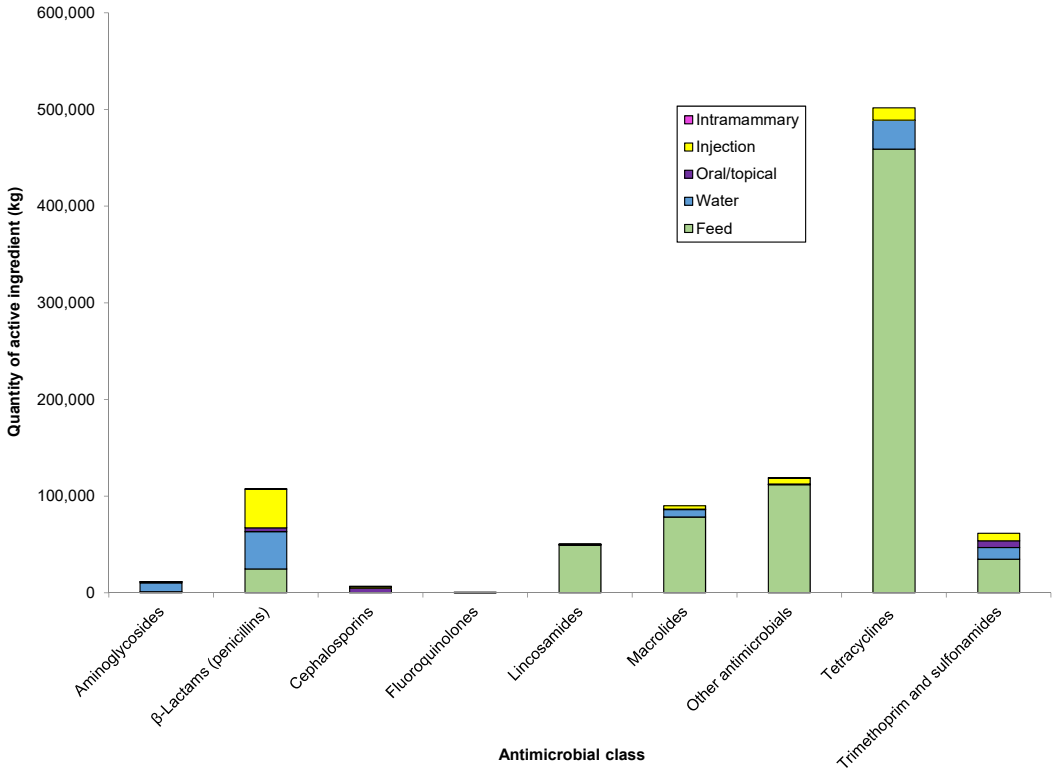
Distribution by route of administration

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, 2017

a) Route of administration



b) Antimicrobial class

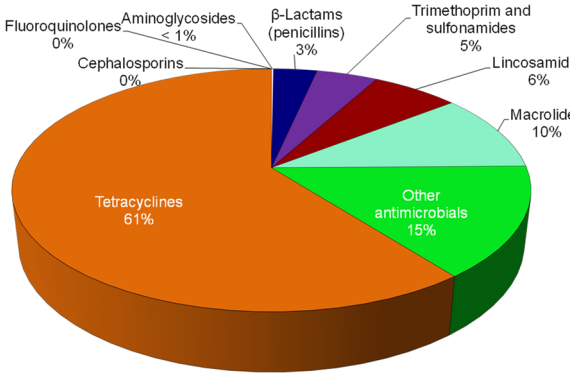


Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

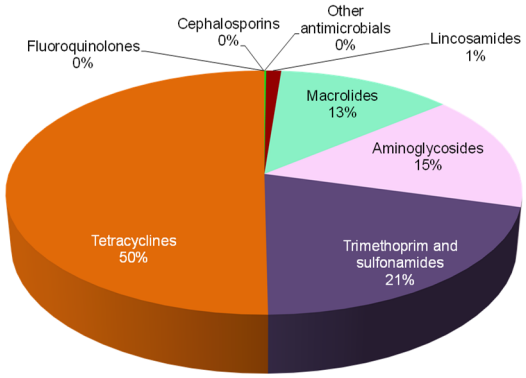
"Other antimicrobials" for 2017 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymixin B, tiamulin, and virginiamycin.

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), 2017

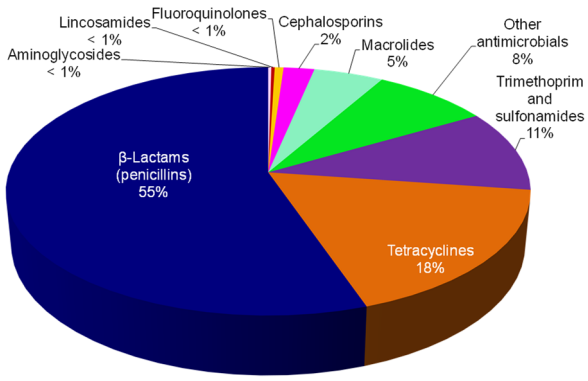
a) Feed



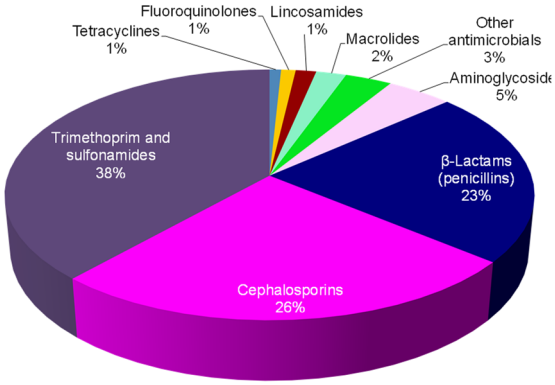
b) Water



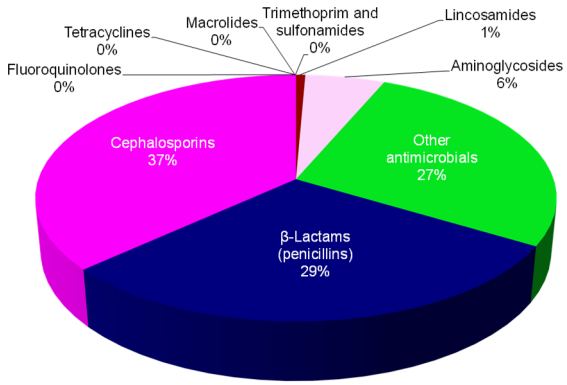
c) Injection



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 2017 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

Antimicrobial distribution data and animal biomass in Canada: the population correction unit (PCU) over time

Table 2. 4 Canadian animal population numbers and population correction unit (PCU), 2017

Animal species	Number of animals and/or kg fish	PCU_{ESVAC} (1,000 tonnes)[a]	PCU_{CAN} (1,000 tonnes)[b]
Cattle	8,349,778	3,279	4,172
Swine	28,295,845	1,873	1,771
Poultry	712,659,718	824	983
Sheep and goats	1,296,830	54	54
Horses	963,500	385	482
Fish	191,416,000	191	191
Rabbit	605,379	1	1
Total production animals		**6,607**	**7,655**
Cats	8,800,000	35	35
Dogs	7,600,000	114	114
Total companion animals		**149**	**149**

For more detailed information on data sources and specific information on production stages, imports, exports, please see Table 2. 5.

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

ESVAC = European Surveillance of Veterinary Antimicrobial Consumption.

CAN = Canadian.

Acknowledging the underlying sources of data structure the information differently, the PCU denominator was harmonized to the greatest extent possible with ESVAC[3]. ESVAC denominator does not include beef cows, whereas in Canada beef cows are a significant population and are included in Figure 2. 7 and Figure 2. 8.

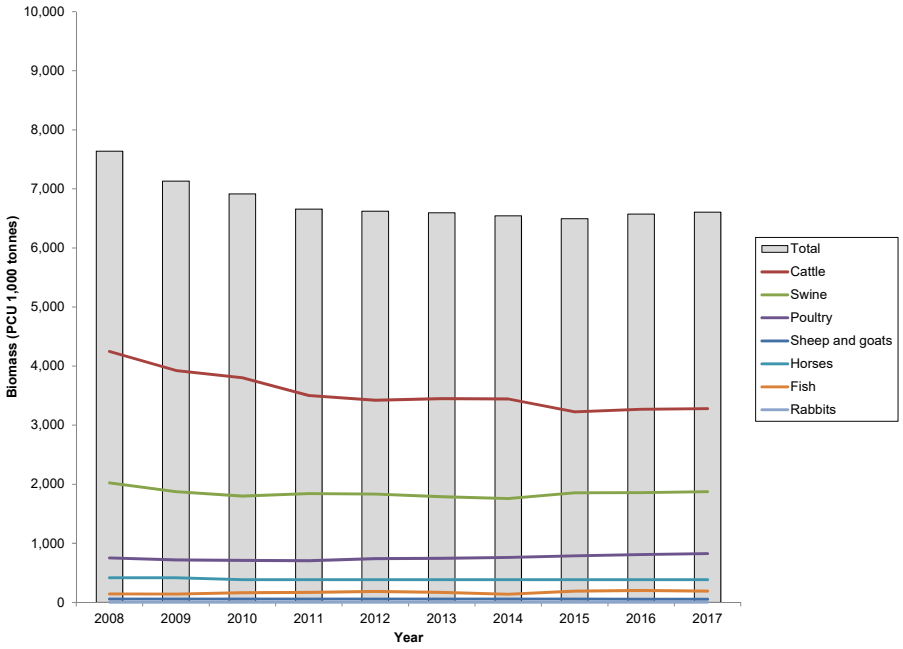
[a] PCU_{ESVAC} is based on ESVAC weights.

[b] PCU_{CAN} is based on Canadian weights.

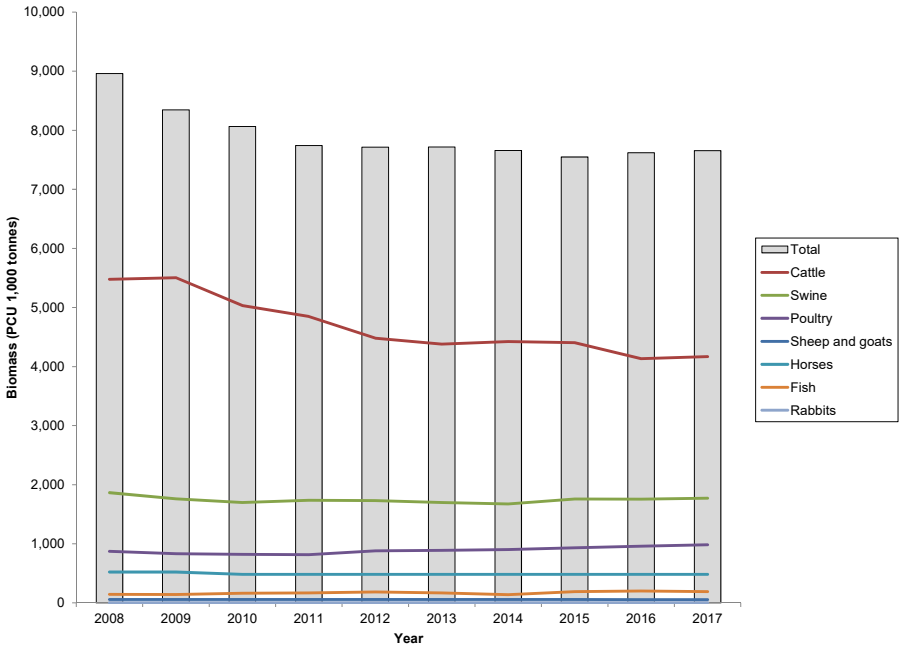
[3] European Medicines Agency, European Surveillance of Veterinary Antimicrobial Consumption. ESVAC Population correction unit template. Available at: http://www.ema.europa.eu/ema/index.jsp?curl=pages/regulation/document_listing/document_listing_000302.jsp. Accessed October 2017.

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, 2008 to 2017

a) European weights



b) Canadian weights



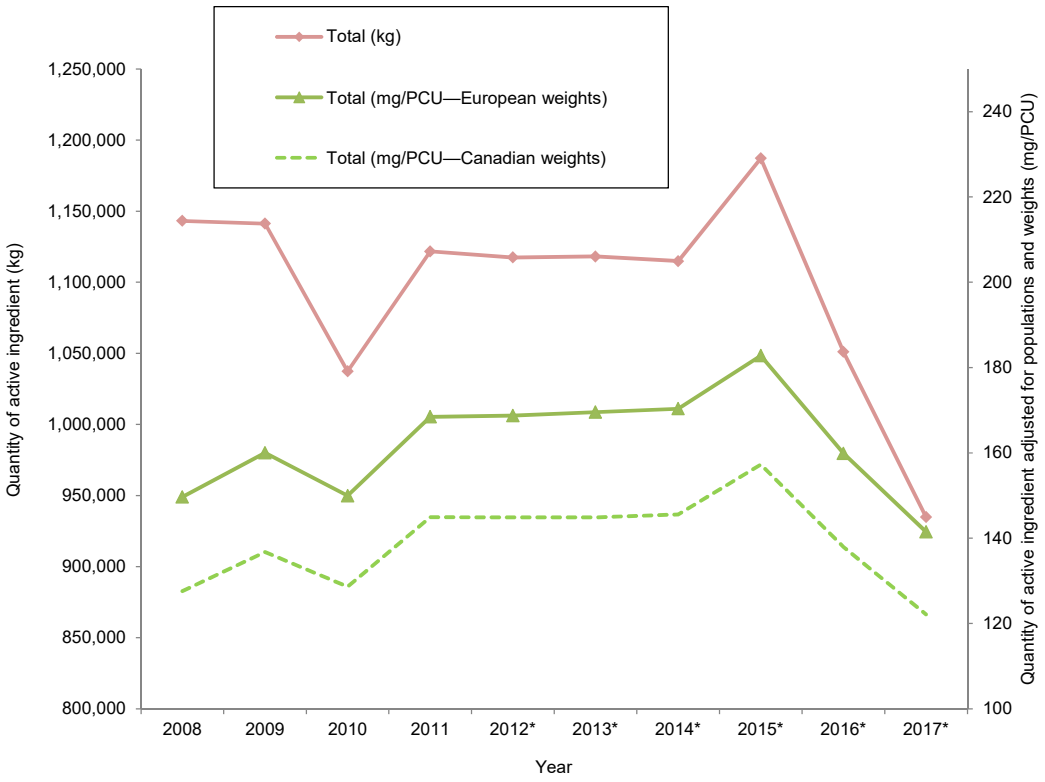
See corresponding footnotes on next page.

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, 2008 to 2017 (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)[4]. 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), 2008 to 2017



PCU = population correction unit.

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

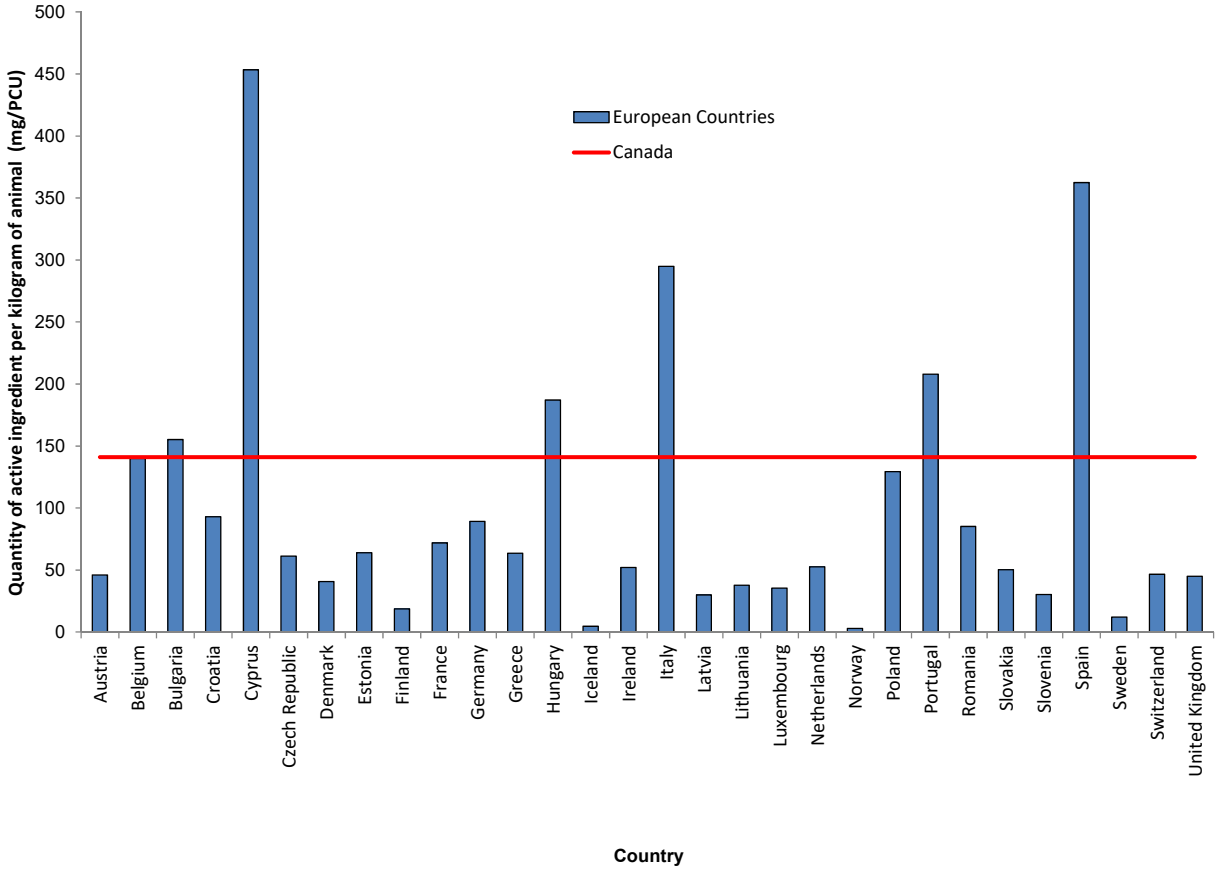
Animal distribution data do not include antimicrobials imported under the "own use" provision or imported as active pharmaceutical ingredients intended for further compounding; hence, are underestimates of total quantities used.

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

[4] 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 October 2016.

International data

Figure 2. 9 Sales of antimicrobials (adjusted by populations and weights) for Canada (2017) and countries participating in the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) network (2016)



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 imported 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)[5]. 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.

Data from all countries shown are using the same average weights at treatment. However, Canadian average weights in many production classes are heavier than European average weights. As per stakeholder request, based on preliminary analysis, the lighter red column for Canada indicates where Canada would rank if Canadian average weights at treatment were used in the calculations.

[5] European Medicines Agency, European Surveillance of Veterinary Antimicrobial Consumption, 2016. "Sales of veterinary antimicrobial agents in 29 European countries in 2014". (EMA/61769/2016). Available at: http://www.ema.europa.eu/docs/en_GB/document_library/Report/2016/10/WC500214217.pdf. Accessed October 2017.

Detailed denominator data

Table 2. 5 Detailed information on population numbers, 2017

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]	2,984,554				
	Cows	Slaughter	471,078	425	200	600	283
	Heifers	Slaughter	912,775	200	183	200	183
	Steers and bulls	Slaughter	1,600,702	425	680	425	680
	Calves	Slaughter[b]	236,459	140	33	249	59
	Slaughter cattle and calves	Export for slaughter to the US[c]	515,722	425	219	425	219
	Calves	Live cattle and calf international import for feeding or slaughter[d]	-129,515	140	-18	249	-32
	Feeder cattle and calves	Export for feeding to US[c]	117,358	140	16	249	29
	Beef cows	On farm[e]	3,680,200	425	1,564	600	2,208
	Dairy cows	On farm[e]	945,000	425	402	575	543
	Total		8,349,778		3,279		4,172
Swine							
	Finishers	Slaughter[f]	21,595,441	65	1,404	65	1,404
	All swine	International import[g]	-3,000	65	0	65	0
	Swine	Export for feeding to US[c]	4,612,315	25	115	3[s]	14
	Swine	Export for slaughter to the US[c]	845,989	65	55	65	55
	Sows and gilts (6 months and over)	On farm[h]	1,245,100	240	299	240	299
	Total		28,295,845		1,873		1,771
Poultry							
	Chickens (categories < 1.4 kg, 1.4 and < 2.7 kg, >2.7 kg)	Slaughter[i]	711,633,973	1	712	1.2	854
	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]	20,202,579	6.5	131	6.5	131
	Poultry (< 185 g)	Live poutry for import[i]	-37,520,386	1	-38	0.2	-8
	Poultry (> 185 g)	Live poutry for import[i]	-82,301	1	0	2	0
	Poultry (< 185 g)	Export[i]	17,380,624	1	17	0.2	3
	Poultry (> 185 g)	Export[i]	1,045,229	1	1	2	2
	Total		712,659,718		824		983
Sheep and goats							
	Sheep and lamb	Slaughter[k]	711,000	20	14	20	14
	Goats	Slaughter[j]	68,977	20	1	20	1
	Sheep and lamb	International import[k]	-300	20	0	20	0
	Sheep and lamb	International export[c]	6,053	20	0	20	0
	Ewes	On farm[m]	511,100	75	38	75	38
	Total		1,296,830		54		54
Horses	Horses	Living[n]	963,500	400	385	500	482
Fish							
	Finfish	Production (kg)[o]	151,342,000	N/A	151	N/A	151
	Shellfish	Production (kg)[o]	40,074,000	N/A	40	N/A	40
	Total		191,416,000		191		191
Rabbits		Slaughter[p]	605,379	1.4	1	1.4	1
Total PCU production animals					**6,607**		**7,655**
Cats	N/A	N/A[q, r]	8,800,000	4	35.2	4	35
Dogs	N/A	N/A[q, r]	7,600,000	15	114	15	114
Total PCU companion animals					**149**		**149**

See corresponding footnotes on next pages.

Table 2. 5 Detailed information on population numbers, 2017 (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=rR&pdctc=&r=105&menupos=1.02.06 and http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?action=rR&pdctc=&r=111&menupos=1.02.06. Accessed September 17, 2018. These data were parsed into various animal categories (cows, heifers, steers and bulls) according to the % 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 17, 2018. 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=rR&pdctc=&r=191. Accessed September 17, 2018.

[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/statistics-and-market-information/by-product-sector/red-meat-and-livestock/red-meat-and-livestock-market-information/supply-sheets-by-species/supply-comparision-by-species-between-canada-and-the-united-states/?id=1415860000063. Accessed September 17, 2018.

[e] Table 003-0032. On all cattle operations. Data for January 1st. Available at: http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0030032&&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=. Accessed September 17, 2018.

[f] Added the number of hogs slaughtered in provincially inspected establishments in Canada to the number of hogs slaughtered in federally inspected establishments. Available at: http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?action=pR&pdctc=&r=111 and http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?action=pR&pdctc=&r=111. Agriculture and Agri-food Canada's Tables A009E and A009A. Accessed: September 17, 2018.

[g] Added for Periods I and II. Statistics Canada. Table 32-10-0147-01 Hogs statistics, supply and disposition of hogs, semi-annual (x 1,000). Available at: http://www5.statcan.gc.ca/cansim/a26?id=0030102&pattern=&p2=-1&tabMode=dataTable&p1=1&stByVal=1&+lang=eng&paSer=&csid=&retrLang=eng&lang=eng. Accessed September 18, 2018.

[h] Number of animals recorded for Period II. Statistics Canada. Table 32-10-0145-01 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=3210014501. Accessed September 18, 2018.

[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: http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?action=pR&r=1&pdctc=. Accessed September 18, 2018.

[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 July 4, 2019.

[k] Statistics Canada. Table 32-10-0126-01 Hogs, sheep and lambs, farm and meat production (x 1,000). Available at: www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0030028&tabMode=dataTable&srchLan=-1&p1=-1&p2=9. Accessed September 18, 2018.

[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/statistics-and-market-information/by-product-sector/red-meat-and-livestock/red-meat-market-information-canadian-industry/by-sector-reports/sheep-lambs-and-goats/goat-slaughtered-in-canada/?id=1415860000044#2014. Accessed September 18, 2018.

[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: www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0030031&tabMode=dataTable&srchLan=-1&p1=-1&p2=9. Accessed September 18, 2018.

Table 2. 5 Detailed information on population numbers, 2017 (continued)

[n] 2010 Canadian Equine Industry Profile Study. Available at: https://www.equestrian.ca/cdn/storage/resources_v2/wf9c32LH4uErLanMs/original/wf9c32LH4uErLanMs.pdf. Accessed September 17, 2018.

[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 May 7, 2019.

[p] Federal and provincial slaughter. Available at: http://www.agr.gc.ca/eng/industry-markets-and-trade/statistics-and-market-information/by-product-sector/red-meat-and-livestock/red-meat-and-livestock-market-information/supply-sheets-by-species/rabbit-industry-at-a-glance/?id=1415860000120. Accessed May 7, 2019.

[q] Companion Animal Health. Canadian Animal Health Institute. Available at: https://www.canadianveterinarians.net/documents/canadian-pet-population-figures-cahi-2017. Accessed September 18, 2018.

[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 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.

Table 2. 6 Quantity of ionophores and chemical coccidiostats (kg) distributed for sale for use in animals, 2008 to 2017

Antimicrobial class aggregation	Quantity of active ingredient (kg)										Change (%) from 2008 to 2017	Change (%) from 2016 to 2017
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017		
Ionophores, chemical anticoccidials, and arsenicals[a]												
Ionophores, chemical coccidiostats, arsenicals, and nitroimidazoles[a]	472,384	491,152	490,355									
Chemical coccidiostats[a]				22,372								
					18,471							
						45,138	104,332	104,067	85,564			
										102,187		
Ionophores[a]				433,332								
					473,595							
						311,652	462,476	466,888	487,113	496,533	NA	2%
Total	**472,384**	**491,152**	**490,355**	**455,704**	**492,066**	**356,790**	**566,808**	**570,955**	**572,677**	**598,721**	**NA**	**5%**

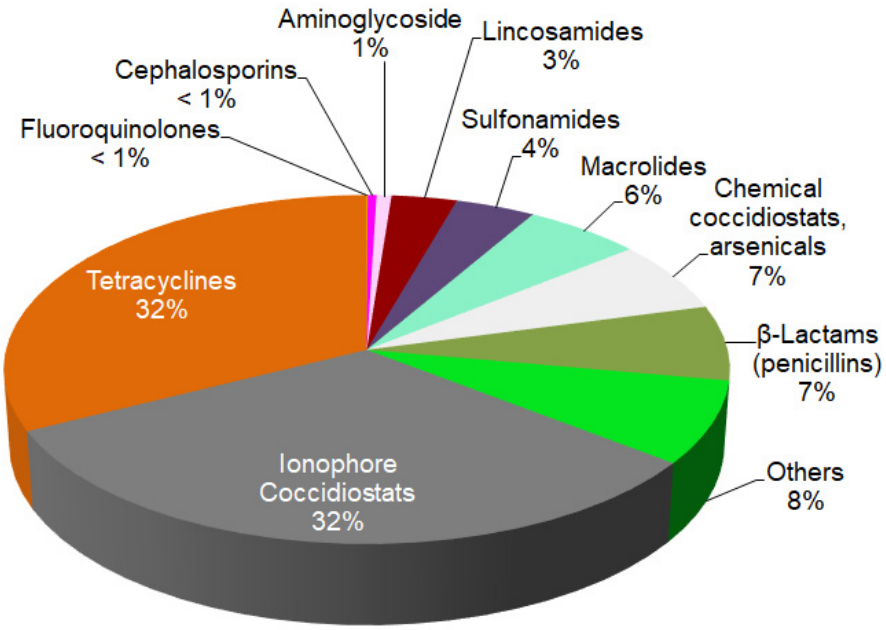
NA = not available or not applicable.

Changes in percentage over time from 2008 to 2017 are relative to the quantities reported in 2008. Changes in percentage over time from 2016 to 2017 are relative to the quantities reported in 2016.

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.

Figure 2. 10 Percentages of the quantities (kg of active ingredient) of antimicrobials distributed for sale for use in animals with ionophores and chemical coccidiostats, 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.

"Other antimicrobials" for 2017 included: avilamycin, bacitracins, bambermycin, chloramphenicol, chlorhexidine gluconate, florfenicol, fusidic acid, novobiocin, polymyxin B, tiamulin, and virginiamycin.

Farm Surveillance in broiler chickens

Summary of antimicrobials used by routes of administration

Table 2. 7 Number of broiler flocks with reported antimicrobial use by route of administration, 2017

Antimicrobial use	Route of administration			
	Any route[a] n (%)	*In ovo*/subcutaneous n (%)	Feed n (%)	Water n (%)
Any antimicrobial use	112 (81)	37 (27)	112 (82)	11 (8)
No antimicrobial use[b]	26 (19)	101 (73)	25 (18)	126 (92)
Total flocks	**138 (100)**	**138 (100)**	**137 (100)**	**137 (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. 8 (next page).

Table 2. 8 Frequency and quantity of antimicrobial use in broiler chickens, 2017

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	nDDDvetCA/ PCU
Feed					g/tonne			
II	Tylosin	6 (4)	11 (2)	8 (6 ; 14)	22 (22 ; 22)	1	1	0.04
	Penicillin G procaine	13 (9)	24 (5)	7 (3 : 14)	55 (31 ; 110)	5	27	0.92
	Virginiamycin	34 (25)	89 (18)	9 (1 ; 30)	22 (11 ; 44)	13	128	4.38
	Trimethoprim sulfadiazine	7 (5)	7 (1)	10 (3 ; 14)	300 (200 ; 300)	14	61	2.09
III	Bacitracin	73 (53)	192 (38)	9 (2 ; 17)	55 (55 ; 110)	77	224	7.65
	Oxytetracycline	1 (1)	1 (< 1)	10 (10 ; 10)	440 (440 ; 440)	2	4	0.13
IV	Bambermycin	5 (4)	15 (3)	8 (1 ; 11)	2 (2 ; 2)	0.1		
N/A	Avilamycin	37 (27)	67 (13)	8 (2 ; 16)	20 (15 ;30)	8	79	2.69
No AMU in feed		25 (18)	98 (19)					
Total feed, medicated		**112 (82)**	**406 (81)**			**120**	**523**	**17.89**
Water			**Treatment (n)**		**g/Liter**			
II	Amoxicillin	1 (1)	1	5 (5 ; 5)	0.1 (0.1 ; 0.1)	0.4	1	0.03
	Penicillin	1 (1)	1	4 (4 ; 4)	0.2 (0.2 ; 0.2)	2.9	2.0	0.07
	Penicillin-streptomycin	5 (4)	5	5 (4 ; 5)	0.1 (0.1 ; 0.1)	0.6	2	0.05
III	Sulfamethazine	2 (1)	2	6 (6 ; 6)	1.0 (1.0 ; 1.0)	3	0.3	0.01
	Tetracycline	1 (1)	1	4 (4 ; 4)	0.1 (0.1 ; 0.1)	0.1	0.1	0.00
	Tetracycline-neomycin	1 (1)	1	5 (5 ; 5)	0.2 (0.2 ; 0.2)	0.3	0.4	0.01
No AMU in water		126 (92)						
Total water, medicated		**11 (8)**	**17**			**7**	**5.4**	**0.18**
Injection					**mg/egg or chick**			
II	Gentamicin	8 (6)			0.2	0.01	0.03	0.001
	Lincomycin-spectinomycin	27 (20)			0.75	0.1	0.5	0.02
No AMU via injection		**101 (73)**						
Total injection		**37 (27)**				**0.2**	**0.5**	**0.02**
All routes[d]		**112 (81)**				**127**	**529**	**18.09**

See corresponding page for footnotes.

Table 2. 8 Frequency and quantity of antimicrobial use in broiler chickens, 2017 (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 2016 CIPARS Annual Report, 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.

nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed metric description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Table 2. 9 Production, biomass and quantity of antimicrobials used by province/region, 2013 to 2017

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		nDDDvetCA/PCU	
			mean (kg)	mean (days)	(mg)	(kg)[a]	Total	% change[b]	Total	% change[b]	Total	% change[b]
British Columbia	2013	24	1.9	33	54,512,352	522,525	104		484		16	
	2014	29	1.9	33	67,656,030	650,756	104	0	380	-22	12	-22
	2015	25	2.0	33	54,790,215	592,652	92	-11	403	6	14	9
	2016	32	2.0	33	73,658,806	765,987	96	4	493	22	16	21
	2017	30	2.0	34	71,972,475	732,417	98	2	431	-13	15	-9
Prairies	2013	15	1.7	33	58,620,413	453,936	129		482		16	
	2014	37	1.9	34	153,638,071	910,594	169	31	448	-7	15	-6
	2015	38	1.9	34	95,991,943	746,106	129	-24	424	-5	14	-6
	2016	38	1.9	34	137,573,040	857,215	160	25	606	43	20	41
	2017	38	1.9	34	123,628,913	790,810	156	-3	561	-7	19	-6
Ontario	2013	30	2.4	38	132,530,015	740,183	179		688		26	
	2014	42	2.2	36	172,669,256	999,661	173	-4	630	-8	22	-14
	2015	49	2.4	38	228,313,087	1,204,851	189	10	679	8	25	13
	2016	40	2.2	36	111,982,379	884,702	127	-33	603	-11	21	-15
	2017	39	2.3	36	140,688,575	987,244	142	13	613	2	22	3
Québec	2013	28	1.9	33	81,361,944	581,995	139		635		21	
	2014	33	2.0	33	110,529,348	739,406	149	7	594	-6	20	-6
	2015	23	1.8	33	69,394,742	491,834	140	-6	470	-21	15	-22
	2016	26	1.9	33	73,168,534	544,595	134	-5	599	28	19	27
	2017	30	1.9	32	71,134,309	702,314	101	-25	470	-21	15	-22
National[c]	2013	99	2.0	34	326,491,338	2,298,639	142		591		20	
	2014	143	2.0	34	503,883,579	3,300,417	153	7	524	-11	18	-13
	2015	136	2.1	35	447,695,719	3,035,442	147	-3	535	2	19	5
	2016	136	2.0	34	395,928,412	3,052,498	130	-12	576	8	19	5
	2017	138	2.0	34	407,235,868	3,212,784	127	-2	529	-8	18	-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 2016 CIPARS Annual Report, 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.

nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

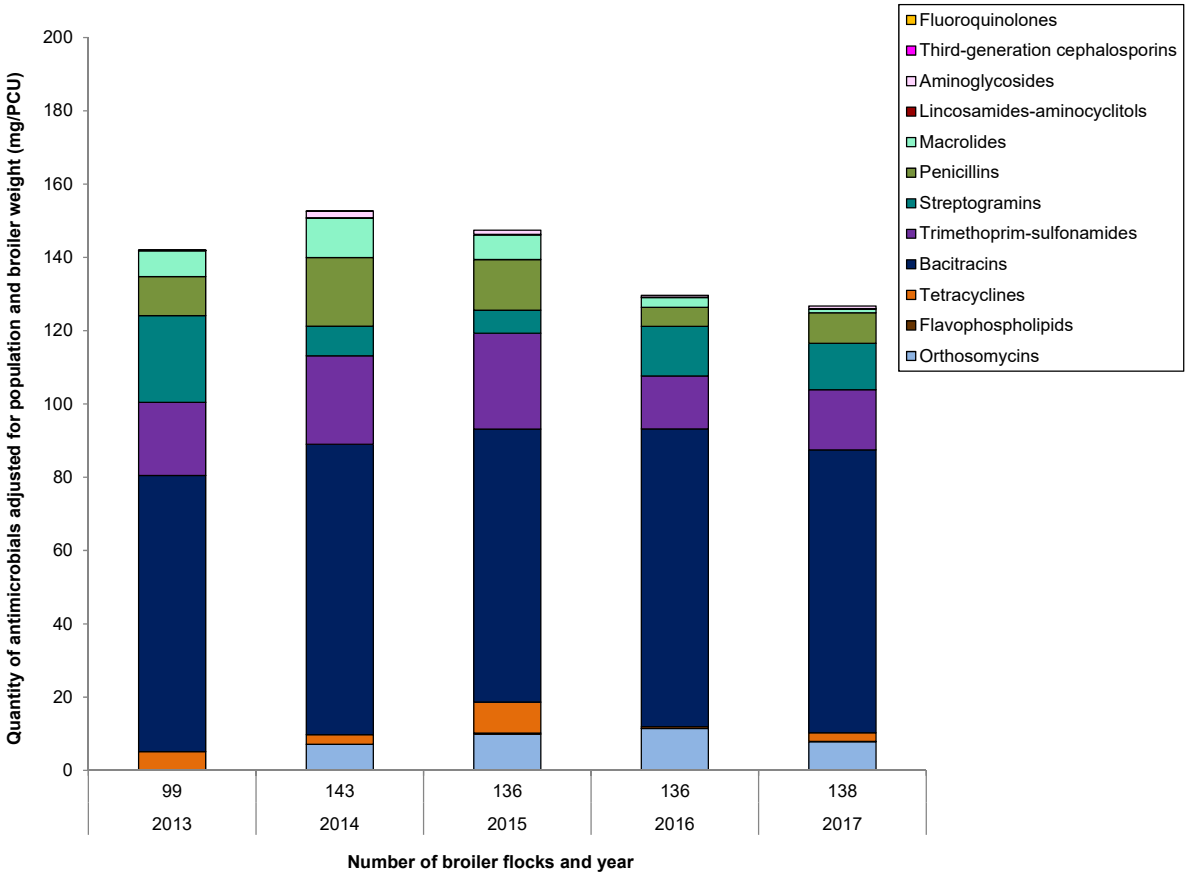
The Prairies is a region including the provinces of Alberta and Saskatchewan.

[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. 11 Quantity of antimicrobial use in all routes of administration, adjusted for population and broiler weight (mg/PCU), 2013 to 2017



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

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).

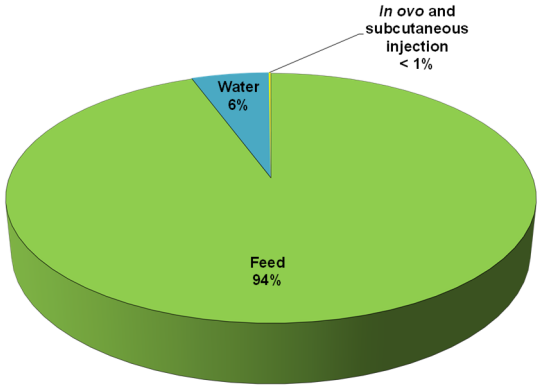
Flavophospholipids intended for growth promotion and had lower dosing than prevention or treatment dosing was not included in the estimates.

mg/PCU = milligrams/population correction unit.

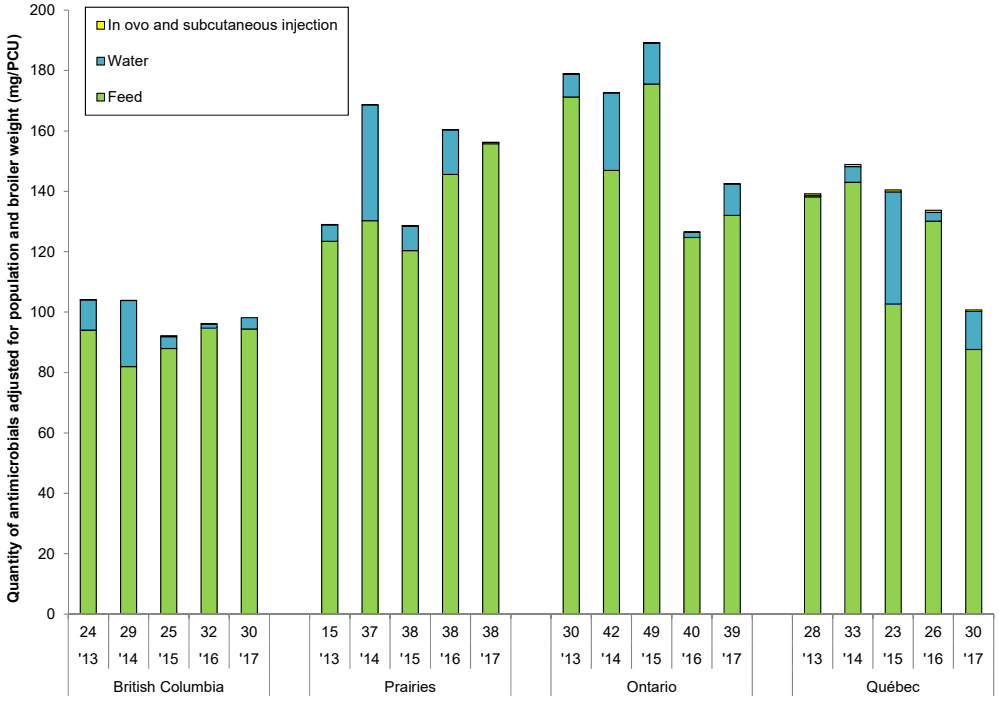
For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Figure 2. 12 Quantity of antimicrobials, adjusted for population and broiler weight (mg/PCU), in 2017 and by province/region, 2013 to 2017

a) 2017



b) by province/region



Number of broiler flocks, year, and province/region

Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of flocks	24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Route of administration																				
Feed	94	82	88	95	94	123	130	120	146	156	171	147	176	125	132	138	143	103	130	88
Water	10	22	4	1	4	5	38	8	15	0	8	26	13	2	10	1	5	37	3	13
In ovo and subcutaneous injection	0.1	0.1	0.3	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.2	0.0	0.0	0.6	0.6	0.6	0.7	0.5
Total	**104**	**104**	**92**	**96**	**98**	**129**	**169**	**129**	**160**	**156**	**179**	**173**	**189**	**127**	**142**	**139**	**149**	**140**	**134**	**101**

See corresponding footnotes on next page.

Figure 2. 12 Quantity of antimicrobials, adjusted for population and broiler weight (mg/PCU), in 2017 and by province/region, 2013 to 2017 (continued)

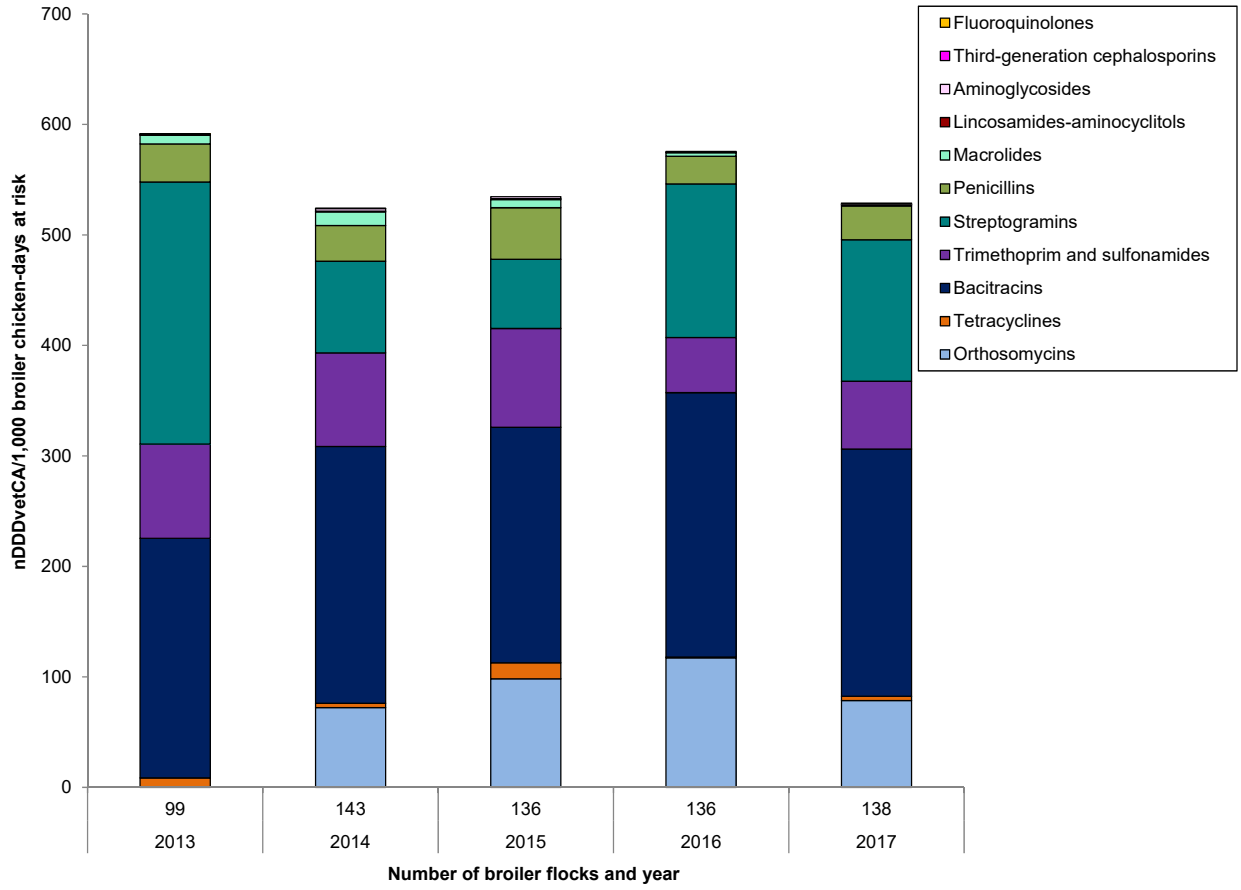
Ionophores, chemical coccidiostats and flavophospholipids used in feed and antiprotozoals used in water (e.g., pyrimethamine, a diaminopyrimidine) were excluded in the estimates above.

mg/PCU = milligrams/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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 2017



Year		2013	2014	2015	2016	2017
Number of flocks		99	143	136	136	138
Antimicrobial class						
I	Fluoroquinolones	0.04	0	0	0	0
	Third-generation cephalosporins	1	0.1	0	0	0
II	Aminoglycosides	0.0	2	2	1	1
	Lincosamides-aminocyclitols	0.5	0.5	1	0.5	0.5
	Macrolides	8	12	7	3	1
	Penicillins	34	33	47	25	31
	Streptogramins	237	83	63	139	128
	Trimethoprim and sulfonamides	85	85	89	50	61
III	Bacitracins	217	232	213	239	224
	Tetracyclines	9	4	15	1	4
N/A	Orthosomycins	0	72	98	117	79
Total		**591**	**524**	**535**	**576**	**529**

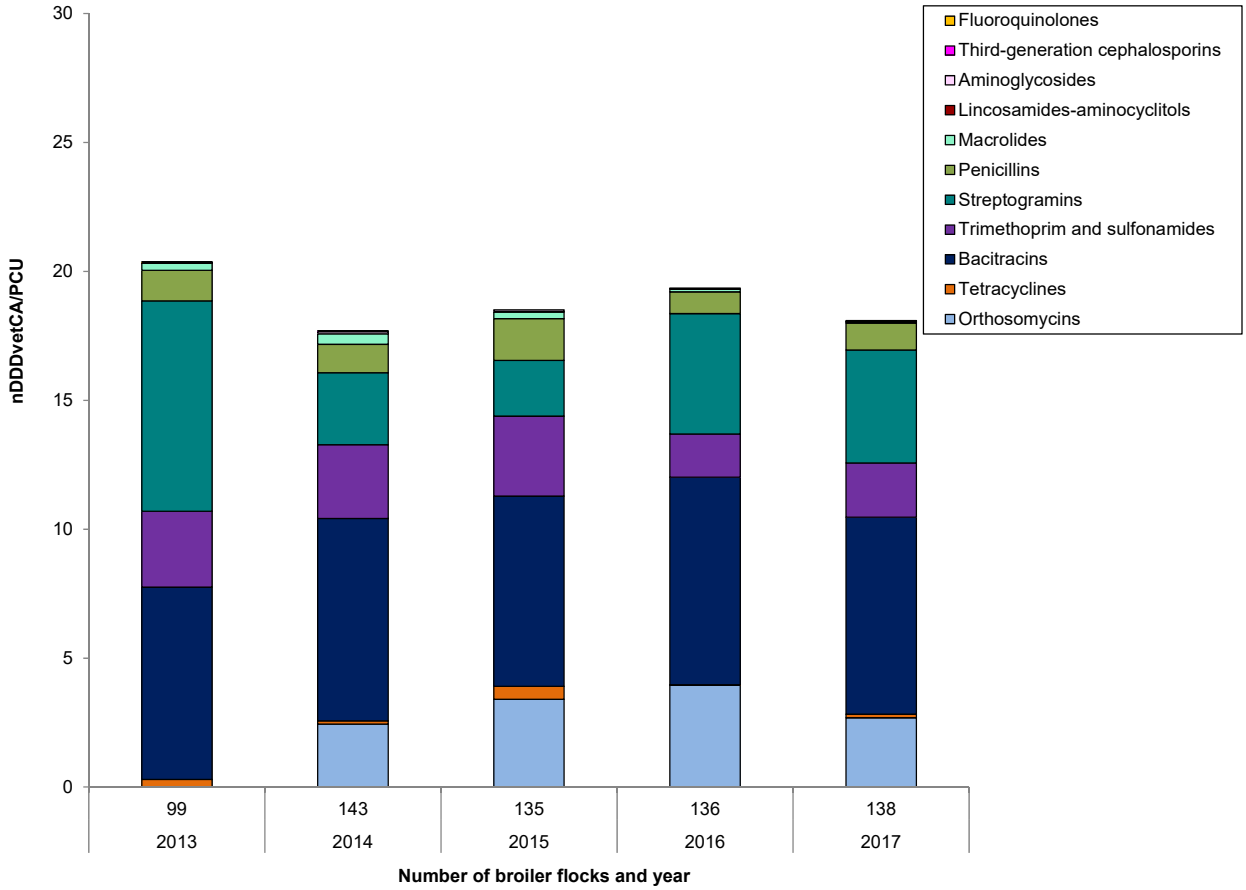
Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).

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 2016 CIPARS Annual Report, 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 description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Figure 2. 14 Number of Canadian Defined Daily Doses for animals per population correction unit (nDDDvetCA/PCU) for all routes of administration, 2013 to 2017



Year Number of flocks		2013 99	2014 143	2015 136	2016 138	2017 138
Antimicrobial class						
I	Fluoroquinolones	< 0.1	0	0	0	0
	Third-generation cephalosporins	< 0.1	< 0.1	0	0	0
II	Aminoglycosides	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Lincosamides-aminocyclitols	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Macrolides	0.3	0.4	0.3	0.1	< 0.1
	Penicillins	1.2	1.1	1.6	0.8	1.0
	Streptogramins	8.2	2.8	2.2	4.7	4.4
	Trimethoprim and sulfonamides	2.9	2.9	3.1	1.7	2.1
III	Bacitracins	7.5	7.8	7.4	8.1	7.6
	Tetracyclines	0.3	0.1	0.5	< 0.1	0.1
N/A	Orthosomycins	0.0	2.4	3.4	3.9	2.7
Total		**20.4**	**17.7**	**18.5**	**19.4**	**18.1**

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 at the time of writing of this report).

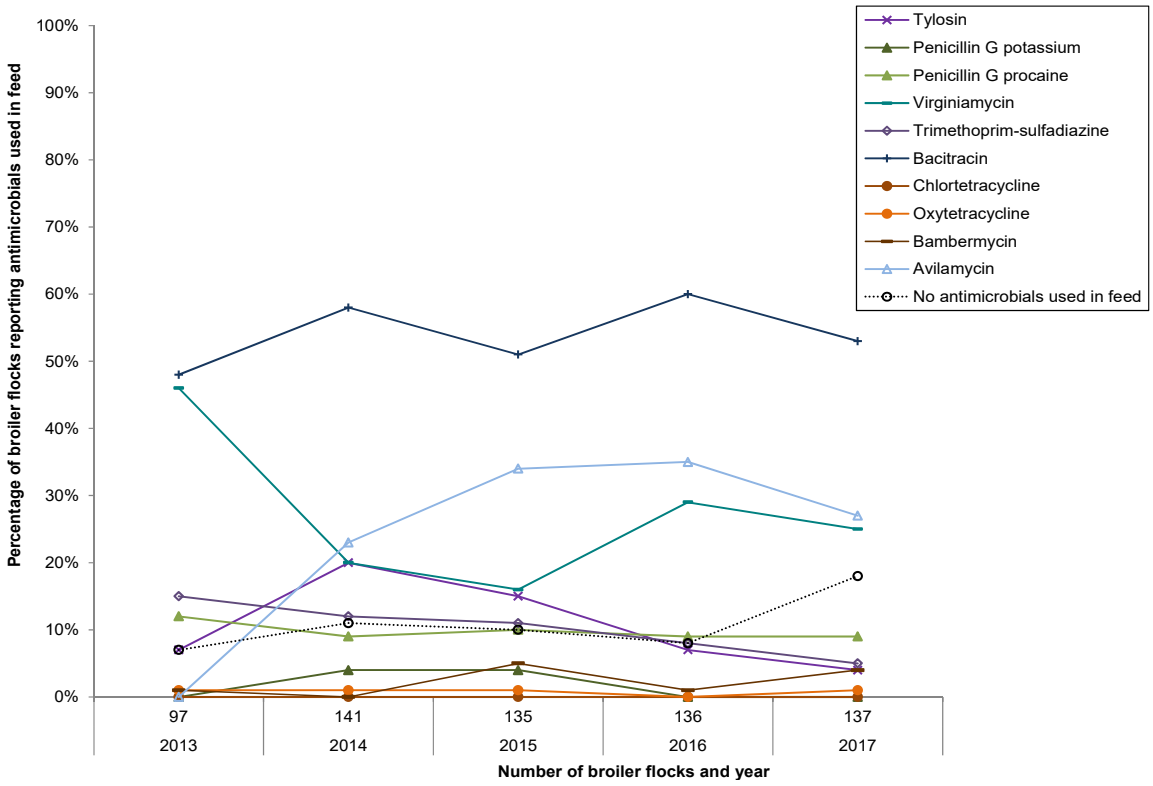
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Antimicrobial use in feed by frequency

Figure 2. 15 Percentage of broiler flocks reporting antimicrobial use in feed, 2013 to 2017



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

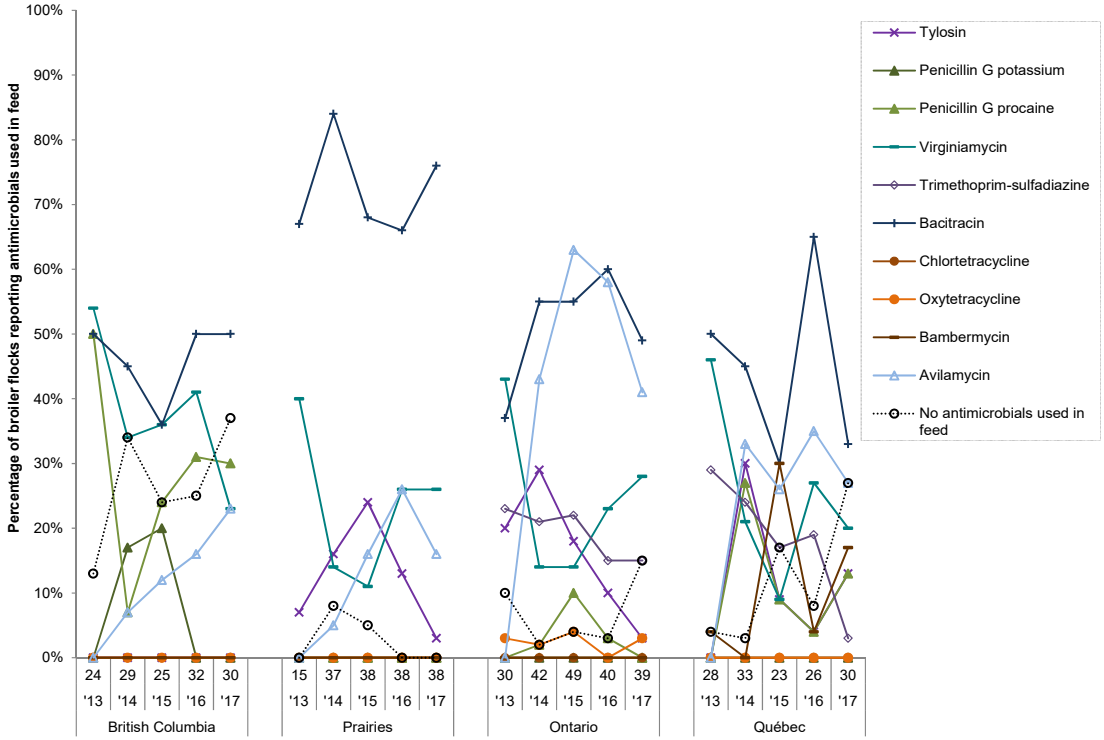
Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).

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. 16 Percentage of broiler flocks reporting antimicrobial use in feed by province/region, 2013 to 2017



Number of broiler flocks, year and province/region

Province/region		British Columbia					Prairies					Ontario					Québec				
Year		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks		24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Antimicrobial																					
	Tylosin	0%	0%	0%	0%	0%	7%	16%	24%	13%	3%	20%	29%	18%	10%	3%	0%	30%	9%	4%	13%
	Penicillin G potassium	0%	17%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
II	Penicillin G procaine	50%	7%	24%	31%	30%	0%	0%	0%	0%	0%	0%	2%	10%	3%	0%	0%	27%	9%	4%	13%
	Virginiamycin	54%	34%	36%	41%	23%	40%	14%	11%	26%	26%	43%	14%	14%	23%	28%	46%	21%	9%	27%	20%
	Trimethoprim-sulfadiazine	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	23%	21%	22%	15%	15%	29%	24%	17%	19%	3%
	Bacitracin	50%	45%	36%	50%	50%	67%	84%	68%	66%	76%	37%	55%	55%	60%	49%	50%	45%	30%	65%	33%
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%	3%	2%	4%	0%	3%	0%	0%	0%	0%	0%
IV	Bambermycin	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%	30%	4%	17%
NA	Avilamycin	0%	7%	12%	16%	23%	0%	5%	16%	26%	16%	0%	43%	63%	58%	41%	0%	33%	26%	35%	27%
	No antimicrobials used in feed	13%	34%	24%	25%	37%	0%	8%	5%	0%	0%	10%	2%	4%	3%	15%	4%	3%	17%	8%	27%

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.

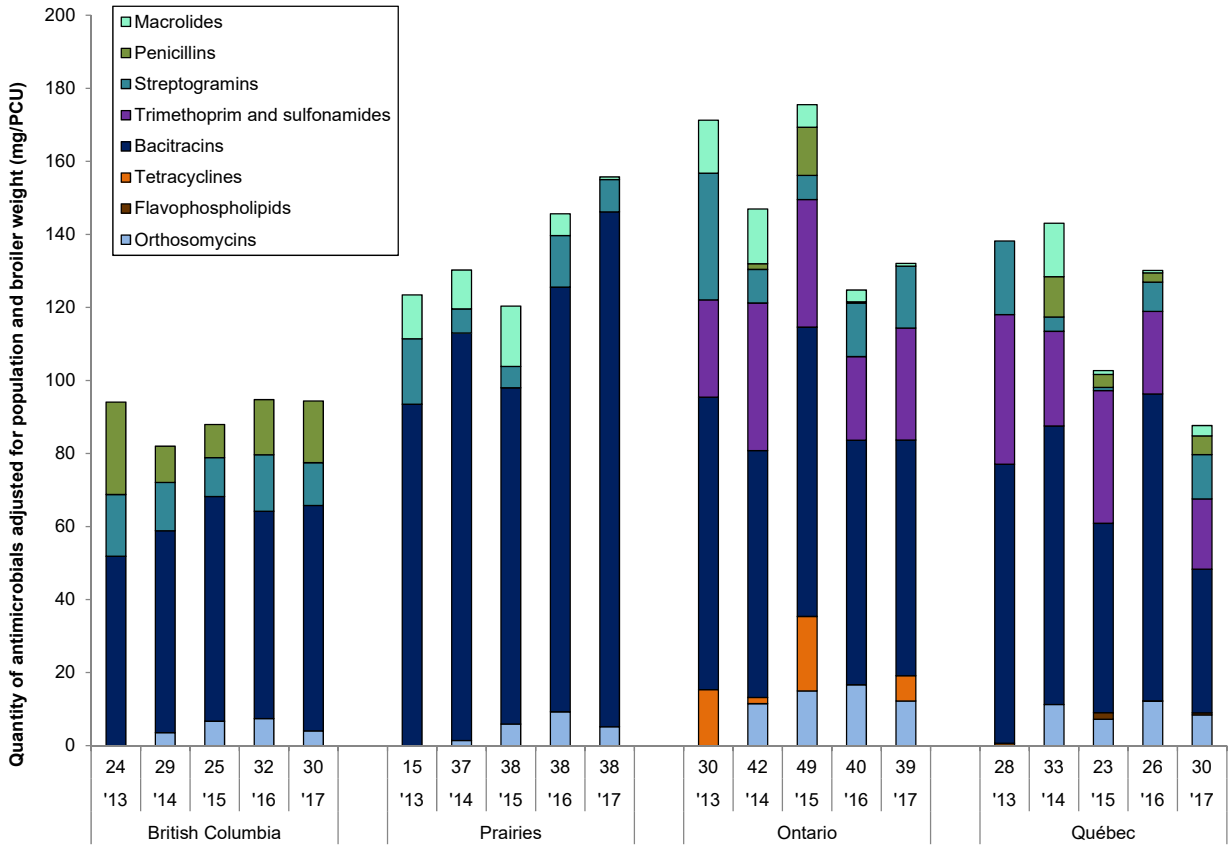
For the temporal analyses by province/region, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in the first and the previous surveillance year (grey areas). The presence of blue areas indicates 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 (2016 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. 17 Quantity of antimicrobial use in feed adjusted for population and broiler weight (mg/PCU), 2013 to 2017



Number of broiler flocks, year, and province/region

Province/region		British Columbia					Prairies					Ontario					Québec				
Year		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks		24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Antimicrobial class																					
II	Macrolides	0	0	0	0	0	12	11	16	6	1	14	15	6	3	1	0	15	1	1	3
II	Penicillins	25	10	9	15	17	0	0	0	0	0	0	2	13	0	0	0	11	3	2	5
II	Streptogramins	17	13	11	15	12	18	7	6	14	9	35	9	7	15	17	20	4	1	8	12
II	Trimethoprim and sulfonamides	0	0	0	0	0	0	0	0	0	0	27	40	35	23	31	41	26	36	23	19
III	Bacitracins	52	55	61	57	63	93	111	92	117	141	80	68	79	67	65	76	76	52	84	39
III	Tetracyclines	0	0	0	0	0	0	0	0	0	0	15	2	20	0	7	0	0	0	0	0
IV	Flavophospholipids	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	1
N/A	Orthosomycins	0	4	7	7	4	0	1	6	9	5	0	11	15	17	12	0	11	7	12	8
Total		**94**	**82**	**88**	**95**	**96**	**123**	**130**	**120**	**146**	**156**	**171**	**147**	**175**	**125**	**132**	**138**	**143**	**103**	**130**	**88**

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).

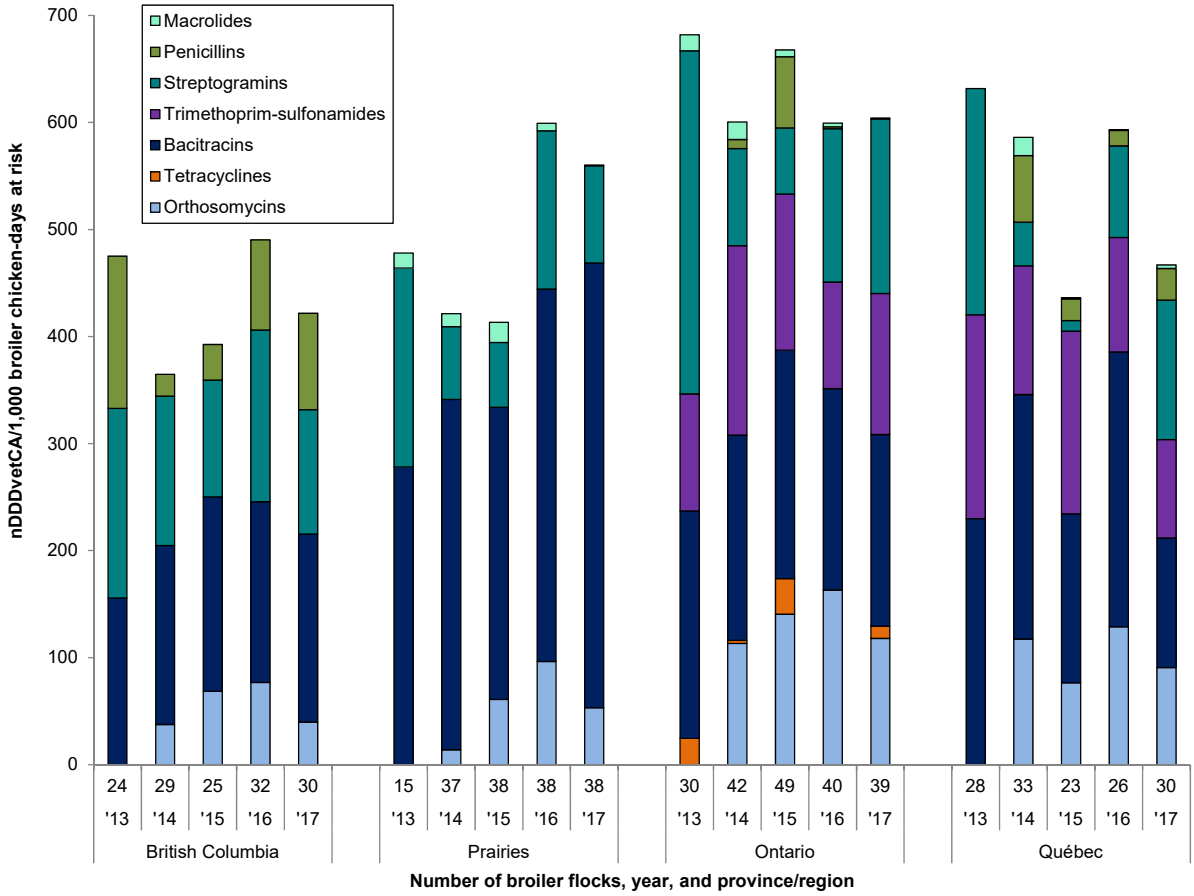
Flavophospholipids intended for growth promotion and had lower dosing than prevention or treatment dosing was not included in the estimates.

mg/PCU = milligrams/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Figure 2. 18 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, 2013 to 2017



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of flocks		24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Antimicrobial class																					
II	Macrolides	0	0	0	0	0	14	12	19	7	1	15	17	7	4	1	0	17	1	1	3
	Penicillins	142	20	33	84	90	0	0	0	0	0	0	8	66	2	0	0	62	20	14	30
	Streptogramins	177	139	109	161	116	186	68	60	148	91	321	91	62	143	163	211	41	10	86	130
	Trimethoprim and sulfonamides	0	0	0	0	0	0	0	0	0	0	109	177	146	100	132	191	120	171	107	92
III	Bacitracins	156	167	182	169	176	278	327	273	348	415	212	192	213	188	179	230	229	158	257	121
	Tetracyclines	0	0	0	0	0	0	0	0	0	0	25	3	33	0	12	0	0	0	0	0
N/A	Orthosomycins	0	38	68	77	40	0	14	61	96	53	0	113	141	163	118	0	117	77	129	91
Total		**475**	**365**	**393**	**490**	**422**	**478**	**421**	**413**	**599**	**560**	**682**	**601**	**668**	**600**	**604**	**632**	**586**	**436**	**593**	**467**

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).

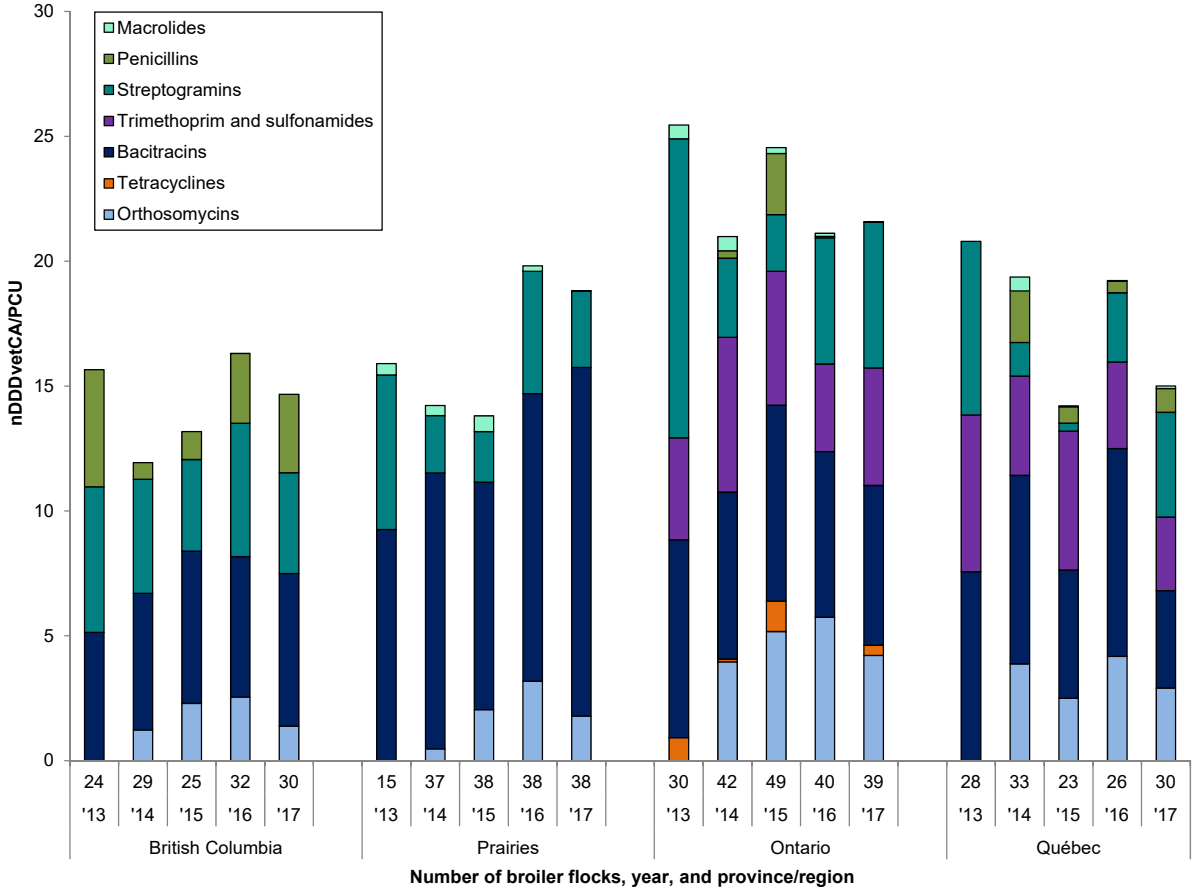
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

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

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Figure 2. 19 Number of Canadian Defined Daily Doses for animals per population correction unit (nDDDvetCA/PCU) for antimicrobials administered in feed, 2013 to 2017



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of flocks		24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Antimicrobial class																					
II	Macrolides	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0
II	Penicillins	5	1	1	3	3	0	0	0	0	0	0	0	2	0	0	0	2	1	0	1
II	Streptogramins	6	5	4	5	4	6	2	2	5	3	12	3	2	5	6	7	1	0	3	4
II	Trimethoprim and sulfonamides	0	0	0	0	0	0	0	0	0	0	4	6	5	4	5	6	4	6	3	3
III	Bacitracins	5	5	6	6	6	9	11	9	12	14	8	7	8	7	6	8	8	5	8	4
III	Tetracyclines	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
N/A	Orthosomycins	0	1	2	3	1	0	0	2	3	2	0	4	5	6	4	0	4	2	4	3
Total		**16**	**12**	**13**	**16**	**15**	**16**	**14**	**14**	**20**	**19**	**25**	**21**	**25**	**21**	**22**	**21**	**19**	**14**	**19**	**15**

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 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

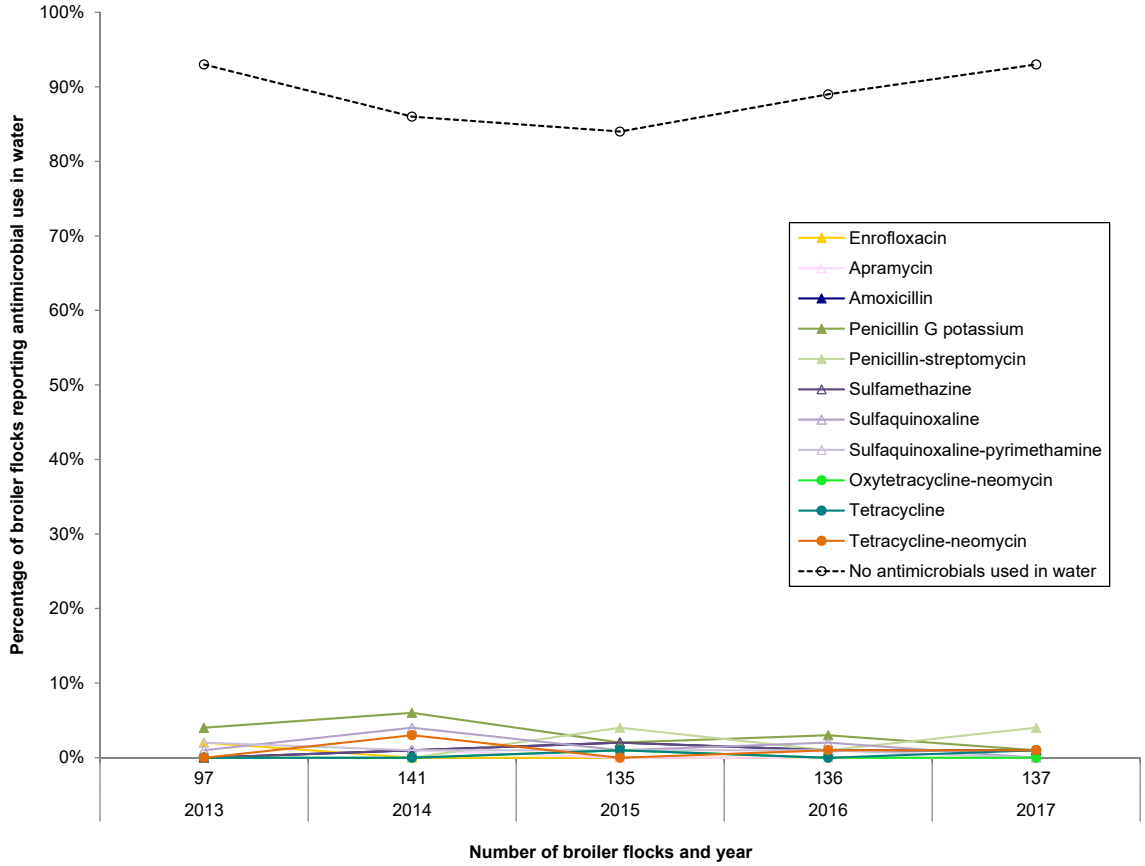
nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Antimicrobial use in water by frequency

Figure 2. 20 Percentage of broiler flocks reporting antimicrobial use in water, 2013 to 2017



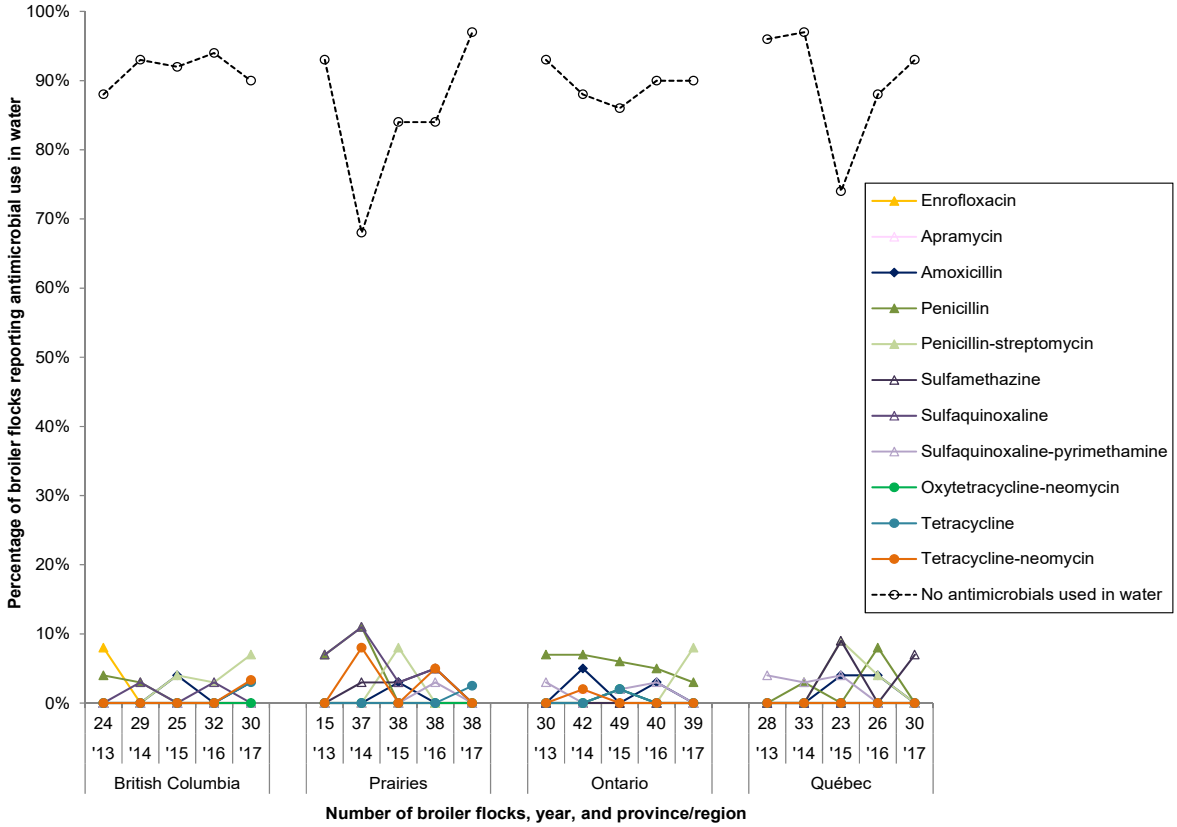
Year		2013	2014	2015	2016	2017
Number of flocks		97	141	135	136	137
Antimicrobial						
I	Enrofloxacin	**2%**	0%	0%	**0%**	**0%**
II	Apramycin	**0%**	1%	0%	**0%**	**0%**
	Amoxicillin	**0%**	1%	2%	**1%**	**1%**
	Penicillin G potassium	**4%**	6%	2%	**3%**	**1%**
	Penicillin-streptomycin	**0%**	0%	4%	**1%**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

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. 21 Percentage of broiler flocks reporting antimicrobial use in water by province/region, 2013 to 2017



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks	24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Antimicrobial																				
I Enrofloxacin	**8%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
II Apramycin	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	2%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
II Amoxicillin	**0%**	0%	4%	**0%**	**3%**	**0%**	0%	3%	**0%**	**0%**	**0%**	5%	0%	**3%**	**0%**	**0%**	0%	4%	**4%**	**0%**
II Penicillin G potassium	**4%**	3%	0%	**0%**	**0%**	**7%**	11%	0%	**0%**	**0%**	**7%**	7%	6%	**5%**	**3%**	**0%**	3%	0%	**8%**	**0%**
II Penicillin-streptomycin	**0%**	0%	4%	**3%**	**7%**	**0%**	0%	8%	**0%**	**0%**	**0%**	0%	0%	**0%**	**8%**	**0%**	0%	9%	**4%**	**0%**
III Sulfamethazine	**0%**	0%	0%	**0%**	**0%**	**0%**	3%	3%	**5%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	9%	**0%**	**7%**
III Sulfaquinoxaline	**0%**	3%	0%	**3%**	**0%**	**7%**	11%	3%	**5%**	**0%**	**0%**	0%	2%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
III Sulfaquinoxaline-pyrimethamine	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**3%**	**0%**	**3%**	0%	2%	**3%**	**0%**	**4%**	3%	4%	**0%**	**0%**
III Oxytetracycline-neomycin	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	2%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
III Tetracycline	**0%**	0%	0%	**0%**	**3%**	**0%**	0%	0%	**0%**	**3%**	**0%**	0%	2%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
III Tetracycline-neomycin	**0%**	0%	0%	**0%**	**3%**	**0%**	8%	0%	**5%**	**0%**	**0%**	2%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
No antimicrobials used in water	**88%**	93%	92%	**94%**	**90%**	**93%**	68%	84%	**84%**	**97%**	**93%**	88%	86%	**90%**	**90%**	**96%**	97%	74%	**88%**	**93%**

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

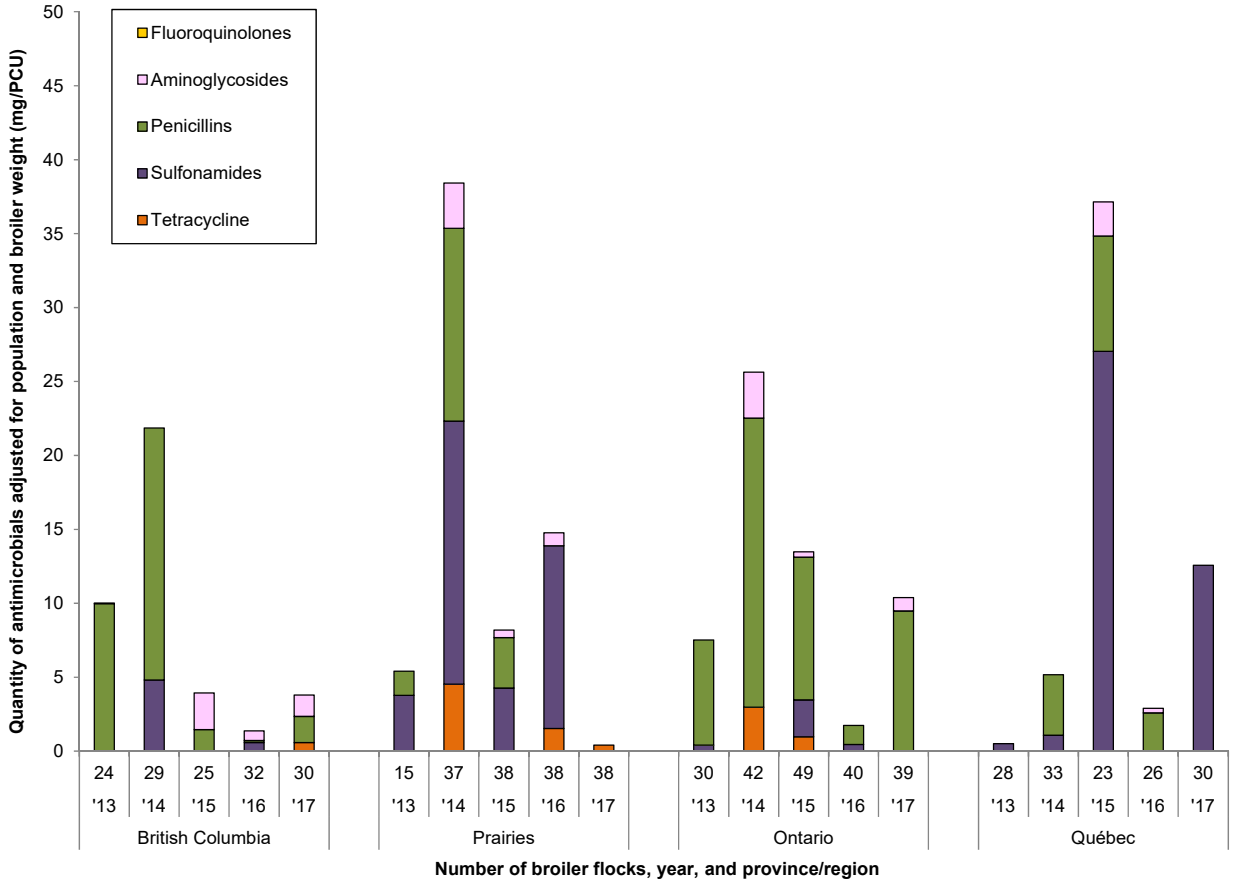
Numbers per column may not add up to 100% as some flocks have used an antimicrobial more than once or used multiple antimicrobials throughout the growing period.

For the temporal analyses by 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 (2017 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. 22 Quantity of antimicrobial use in water adjusted for population and broiler weight (mg/PCU), 2013 to 2017



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks	24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Antimicrobial class																				
I Fluoroquinolones	< 0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
II Aminoglycosides	0	0	2	1	1	0	3	1	1	0	0	3	0	0	1	0	0	2	0.3	0
II Penicillins	10	17	1	0.1	1.8	2	13	3	0	0	7	20	10	1.3	9.5	0	4	8	2.6	0
III Sulfonamides	0	5	0	1	0	4	18	4	12	0	0	0	2	0	0	1	1	27	0	13
III Tetracyclines	0	0	0	0	1	0	5	0	2	0	0	3	1	0	0	0	0	0	0	0
Total	**10**	**22**	**4**	**1**	**4**	**5**	**38**	**8**	**15**	**0**	**8**	**26**	**13**	**2**	**10**	**1**	**5**	**37**	**3**	**13**

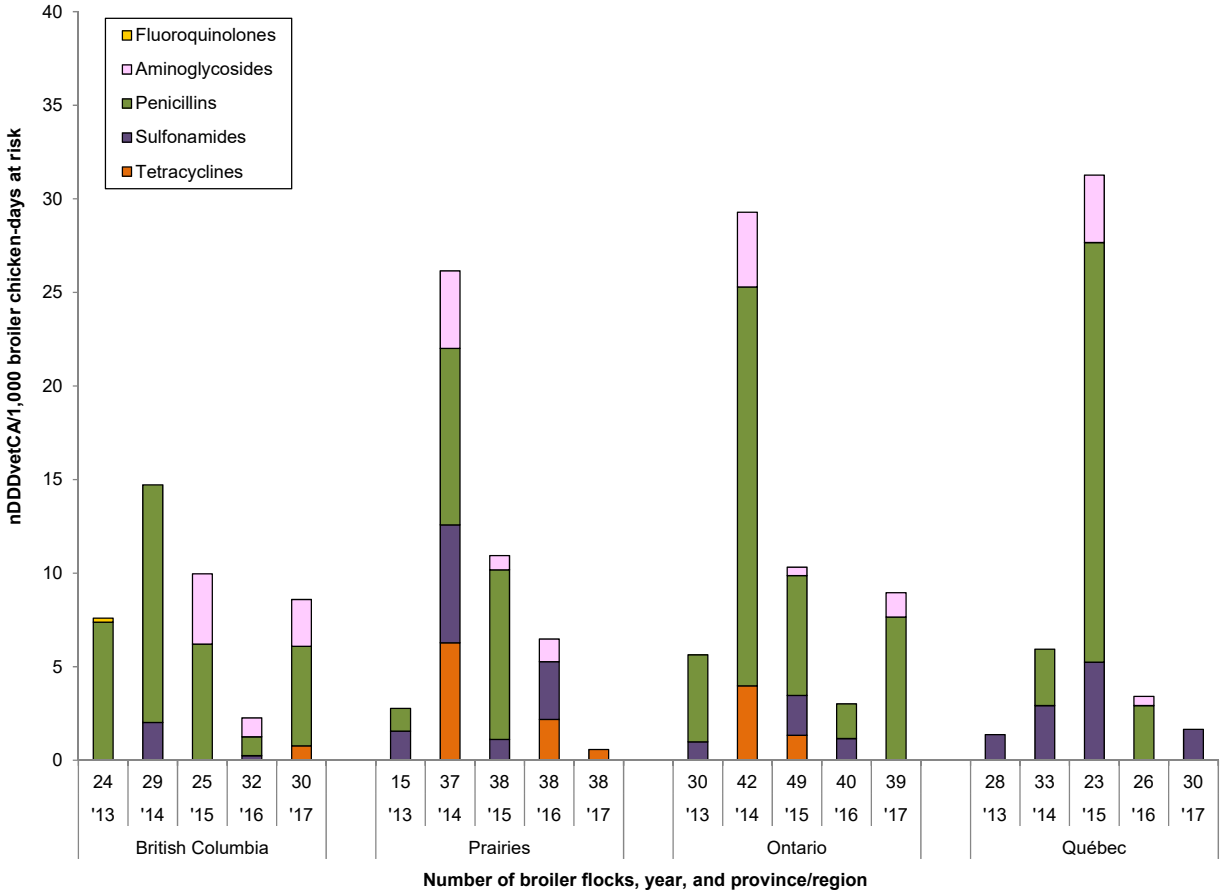
Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

mg/PCU = milligrams/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Figure 2. 23 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, 2013 to 2017



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks	24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Antimicrobial class																				
I Fluoroquinolones	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
II Aminoglycosides	0	0	4	1	2	0	4	1	1	0	0	4	0.4	0	1	0	0	4	0.5	0
II Penicillins	7	13	6	1	5	1	9	9	0	0	5	21	6	2	8	0	3	22	3	0
III Sulfonamides	0	2	0	0.2	0	2	6	1	3	0	1	0	2	1	0	1	3	5	0	2
III Tetracyclines	0	0	0	0	1	0	6	0	2	1	0	4	1	0	0	0	0	0	0	0
Total	**8**	**15**	**10**	**2**	**8**	**3**	**26**	**11**	**6**	**1**	**6**	**29**	**10**	**3**	**9**	**1**	**6**	**31**	**3**	**2**

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

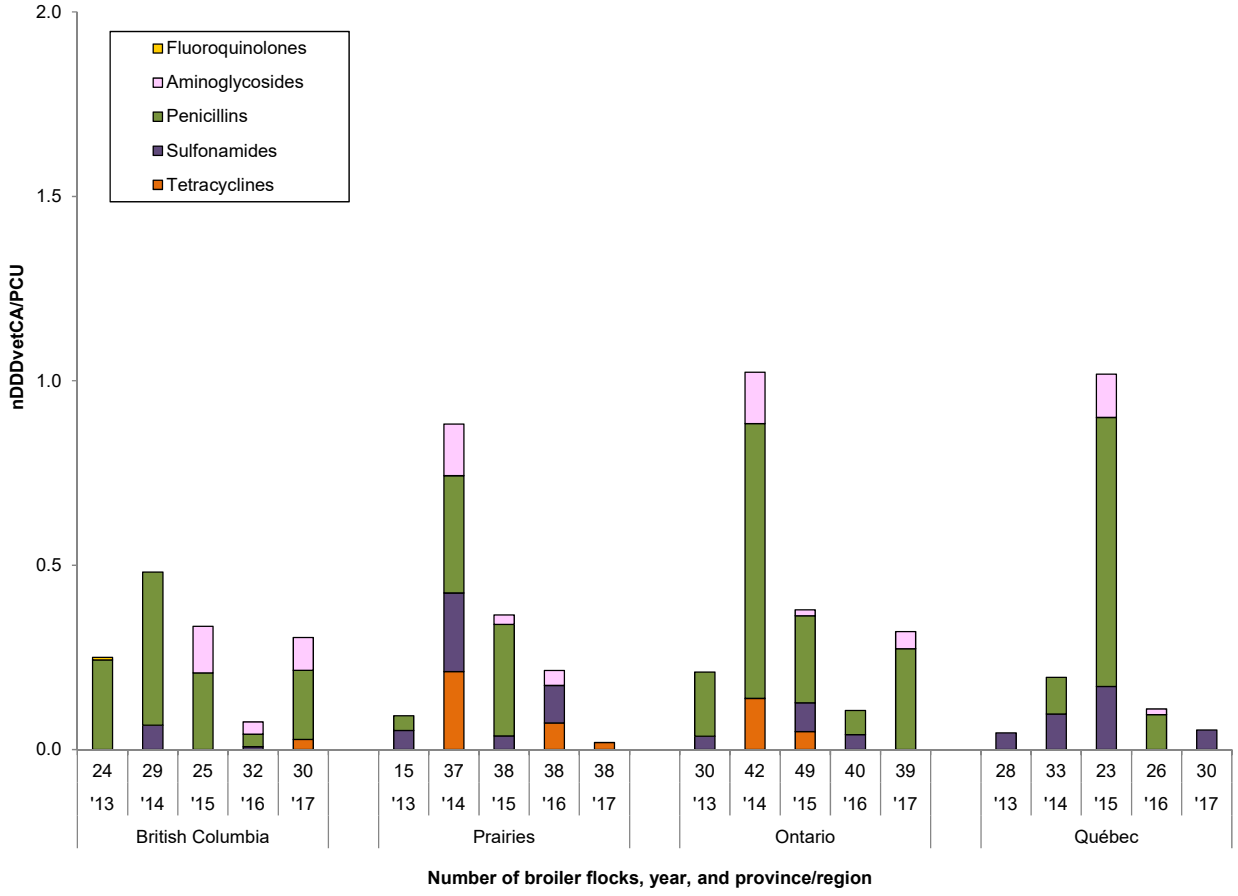
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day ($mg_{drug}/kg_{animal}/day$); please refer to Appendix: Supplemental data of the 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

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

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Figure 2. 24 Number of Canadian Defined Daily Doses for animals per population correction unit (nDDDvetCA/PCU), for antimicrobials administered in water, 2013 to 2017



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks	24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Antimicrobial class																				
I Fluoroquinolones	< 0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
II Aminoglycosides	0	0	0.1	< 0.1	0.1	0	0.1	< 0.1	< 0.1	0	0	0.1	< 0.1	0	< 0.1	0	0	0.1	< 0.1	0
II Penicillins	0.2	0.4	0.2	0.0	0.2	0.0	0.3	0.3	0	0	0.2	0.7	0.2	0.1	0.3	0	0.1	0.7	0.1	0
III Sulfonamides	0	0.1	0	< 0.1	0	0.1	0.2	< 0.1	0.1	0	< 0.1	0	0.1	< 0.1	0	< 0.1	0.1	0.2	0	0.1
III Tetracyclines	0	0	0	0	< 0.1	0	0.2	0	0.1	< 0.1	0	0.1	< 0.1	0	0	0	0	0	0	0
Total	**0.2**	**0.5**	**0.3**	**0.1**	**0.3**	**0.1**	**0.9**	**0.4**	**0.2**	**0.0**	**0.2**	**1.0**	**0.4**	**0.1**	**0.3**	**0.0**	**0.2**	**1.0**	**0.1**	**0.1**

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 the 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

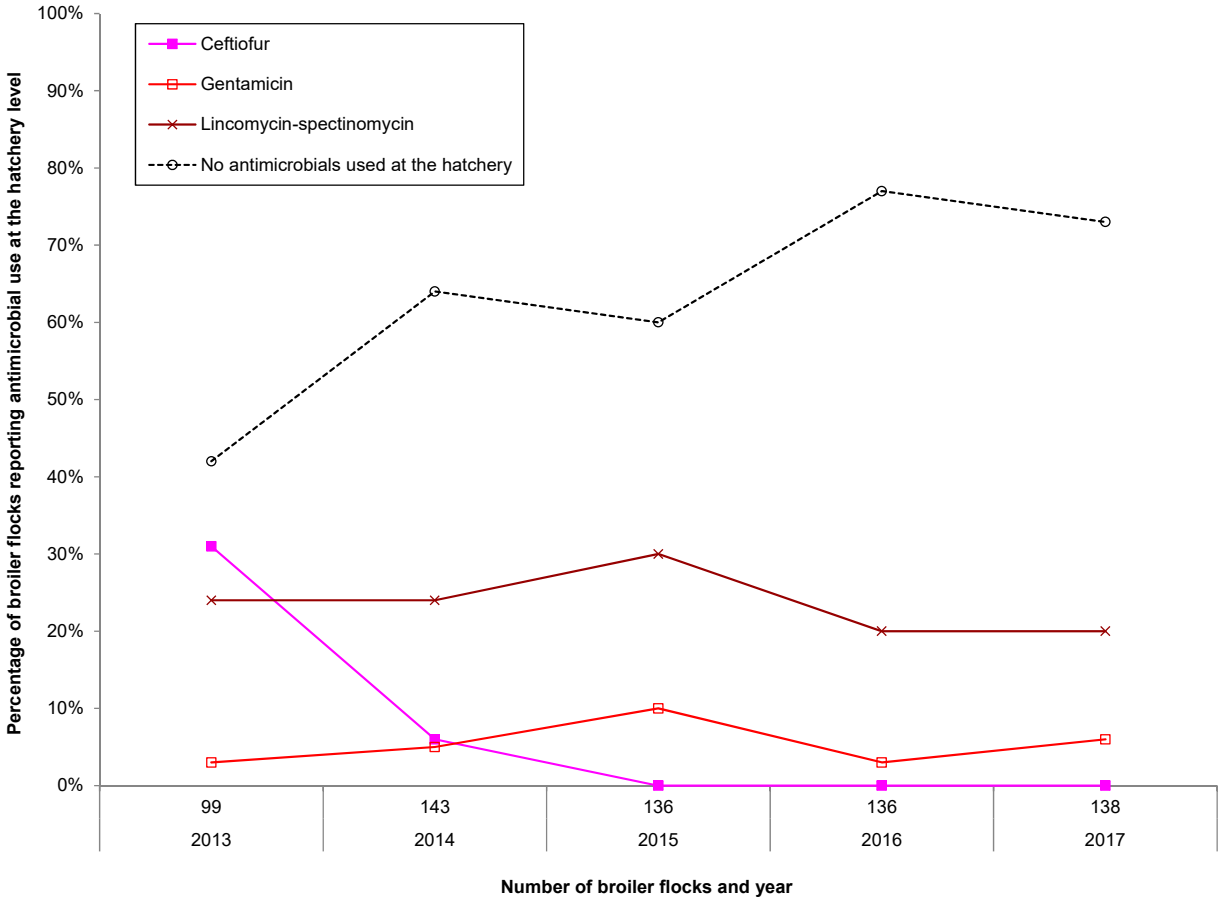
nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Antimicrobial use *in ovo* or subcutaneous injection by frequency

Figure 2. 25 Percentage of broiler flocks reporting antimicrobial use *in ovo* or subcutaneous injection at the hatchery level, 2013 to 2017



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

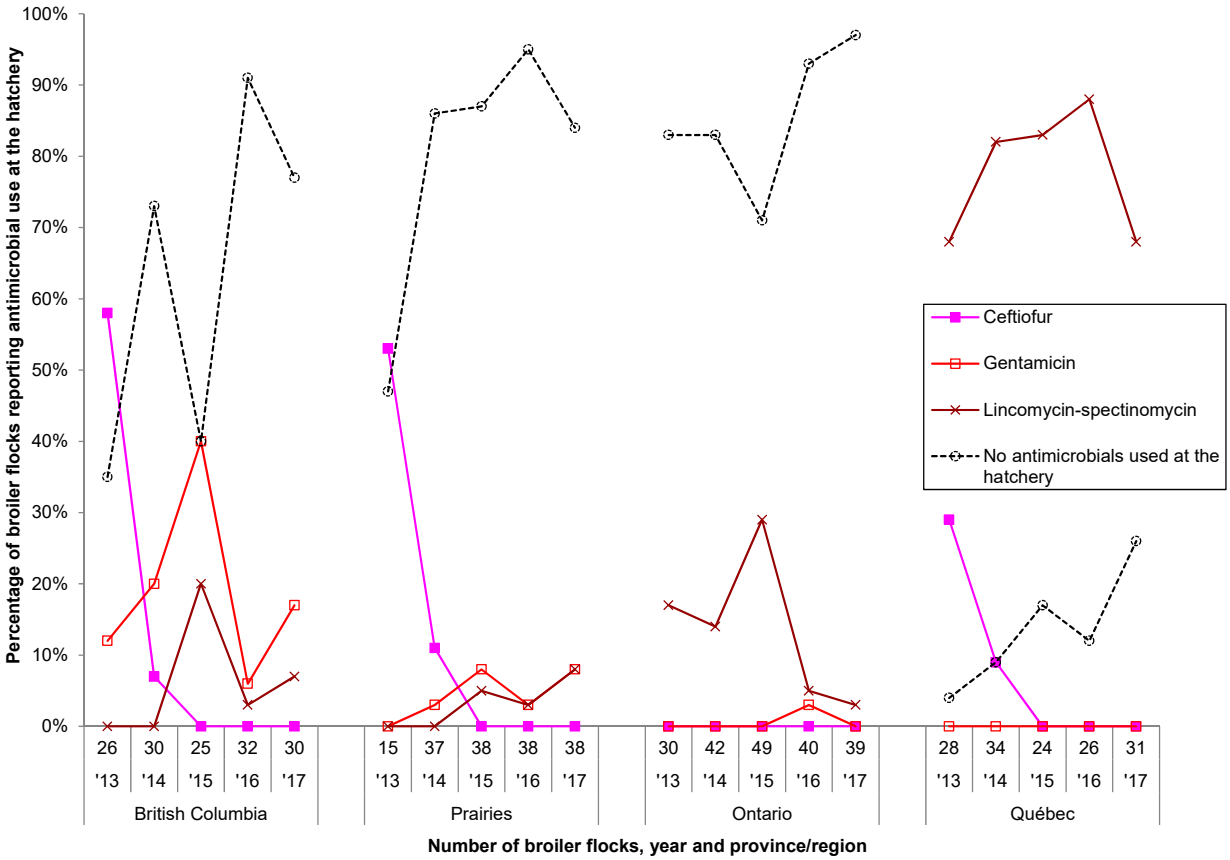
Roman numerals I to II indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

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. 26 Percentage of broiler flocks reporting antimicrobials used *in ovo* or subcutaneous injection at the hatchery level by province/region, 2013 to 2017



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks	26	30	25	32	30	15	37	38	38	38	30	42	49	40	39	28	34	24	26	31
Antimicrobial																				
I Ceftiofur	**58%**	7%	0%	**0%**	**0%**	**53%**	11%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**29%**	9%	0%	**0%**	**0%**
II Gentamicin	**12%**	20%	40%	**6%**	**17%**	**0%**	3%	8%	**3%**	**8%**	**0%**	0%	0%	**3%**	**0%**	**0%**	0%	0%	**0%**	**0%**
II Lincomycin-spectinomycin	**0%**	0%	20%	**3%**	**7%**	**0%**	0%	5%	**3%**	**8%**	**17%**	14%	29%	**5%**	**3%**	**68%**	82%	83%	**88%**	**68%**
No antimicrobials used at the hatchery	**35%**	73%	40%	**91%**	**77%**	**47%**	86%	87%	**95%**	**84%**	**83%**	83%	71%	**93%**	**97%**	**4%**	9%	17%	**12%**	**26%**

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.

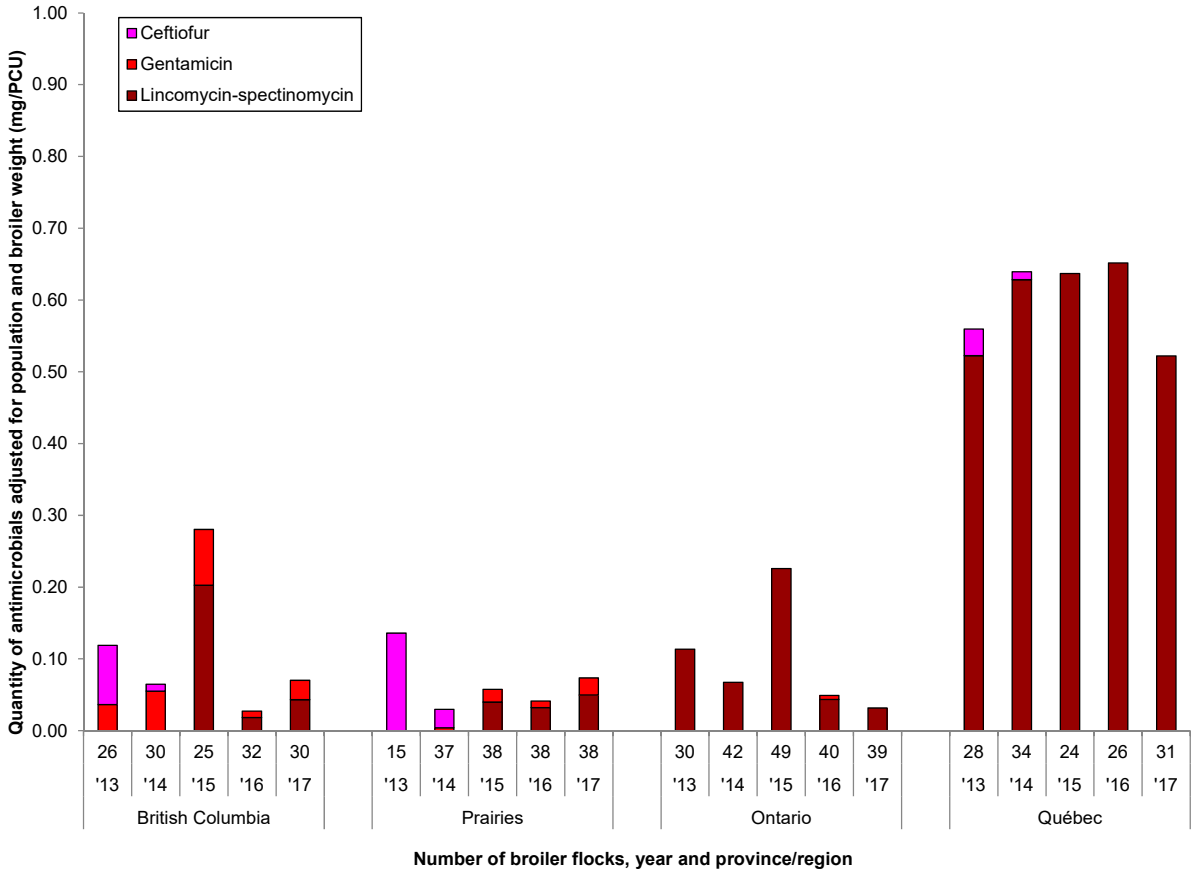
Data represent flocks medicated at the hatchery at day 18 of incubation or upon hatch.

For the temporal analyses by 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 (2017 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. 27 Quantity of antimicrobial use *in ovo* or subcutaneous injections, adjusted for population and broiler weight (mg/PCU), 2013 to 2017



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks	26	30	25	32	30	15	37	38	38	38	30	42	49	40	39	28	34	24	26	31
Antimicrobial																				
I Ceftiofur	0.08	0.01	0	0	0	0.14	0.03	0	0	0	0	0	0	0	0	0.04	0.01	0	0	0
II Gentamicin	0.04	0.06	0.08	0.01	0.03	0	0	0.02	0.01	0.02	0	0	0	0.01	0	0	0	0	0	0
II Lincomycin-spectinomycin	0	0	0.20	0.02	0.04	0	0	0.04	0.03	0.05	0.11	0.07	0.23	0.04	0.03	0.52	0.63	0.64	0.65	0.52
Total	**0.12**	**0.1**	**0.28**	**0.03**	**0.07**	**0.14**	**0.03**	**0.06**	**0.04**	**0.07**	**0.11**	**0.07**	**0.23**	**0.05**	**0.03**	**0.56**	**0.64**	**0.64**	**0.65**	**0.52**

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

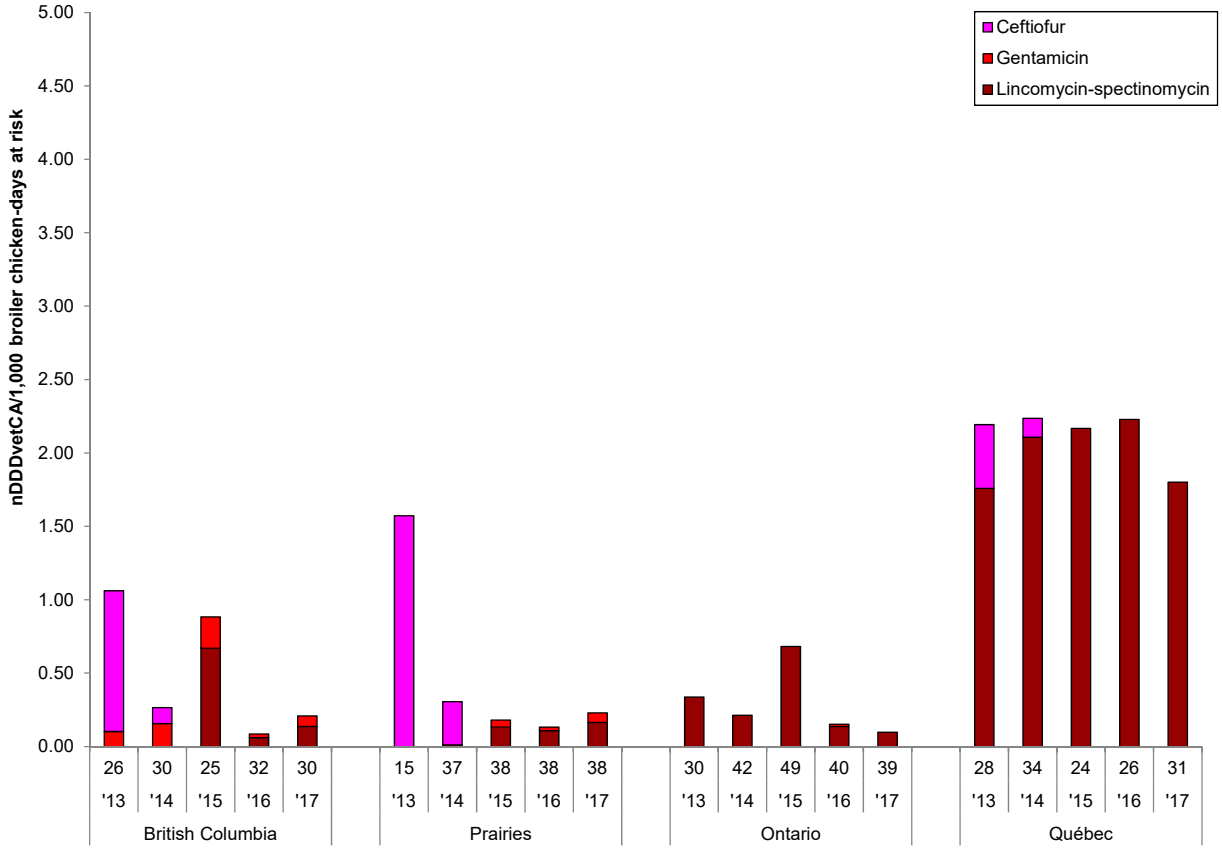
Total milligrams active ingredient was calculated using the final dose (in milligrams per hatching egg or chick) suggested by the manufacturer and expert opinion based on milligrams per body weight or residue avoidance information.

mg/PCU = milligrams/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Figure 2. 28 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, 2013 to 2017



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks		26	30	25	32	30	15	37	38	38	38	30	42	49	40	39	28	34	24	26	31
Antimicrobial																					
I	Ceftiofur	0.96	0.11	0	0	0	1.57	0.30	0	0	0	0	0	0	0	0	0.43	0.13	0	0	0
II	Gentamicin	0.10	0.16	0.21	0.02	0.07	0	0.01	0.05	0.03	0.07	0	0	0	0.01	0	0	0	0	0	0
	Lincomycin-spectinomycin	0	0	0.67	0.06	0.14	0	0	0.13	0.11	0.16	0	0	0.68	0.14	0.10	1.76	2.11	2.17	2.23	1.80
	Total	**1.06**	**0.27**	**0.88**	**0.09**	**0.21**	**1.57**	**0.31**	**0.18**	**0.13**	**0.23**	**0.34**	**0.21**	**0.68**	**0.15**	**0.10**	**2.19**	**2.24**	**2.17**	**2.23**	**1.80**

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

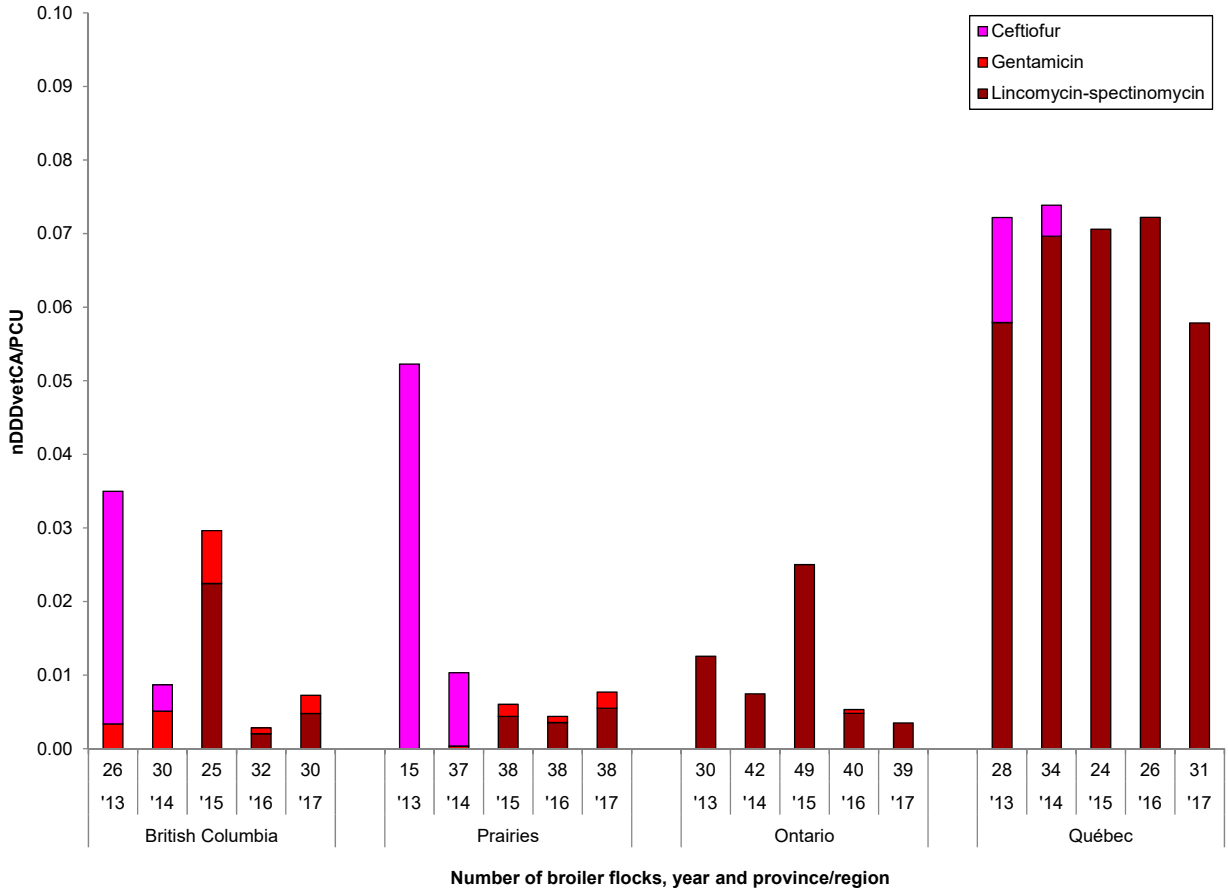
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

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

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Figure 2. 29 Number of Canadian Defined Daily Doses for animals per population correction unit (nDDDvetCA/PCU) for antimicrobials administered *in ovo* or subcutaneous injection, 2013 to 2017



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks		26	30	25	32	30	15	37	38	38	38	30	42	49	40	39	28	34	24	26	31
Antimicrobial																					
I	Ceftiofur	0.032	0.004	0	0	0	0.052	0.010	0	0	0	0	0	0	0	0	0.014	0.004	0	0	0
II	Gentamicin	0.003	0.005	0.007	0.001	0.002	0	0	0.002	0.001	0.002	0	0	0	0.001	0	0	0	0	0	0
	Lincomycin-spectinomycin	0	0	0.022	0.002	0.005	0	0	0.004	0.004	0.005	0.013	0.007	0.025	0.005	0.004	0.058	0.070	0.071	0.072	0.058
	Total	**0.035**	**0.009**	**0.030**	**0.003**	**0.007**	**0.052**	**0.010**	**0.006**	**0.004**	**0.008**	**0.013**	**0.007**	**0.025**	**0.005**	**0.004**	**0.072**	**0.074**	**0.071**	**0.072**	**0.058**

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 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

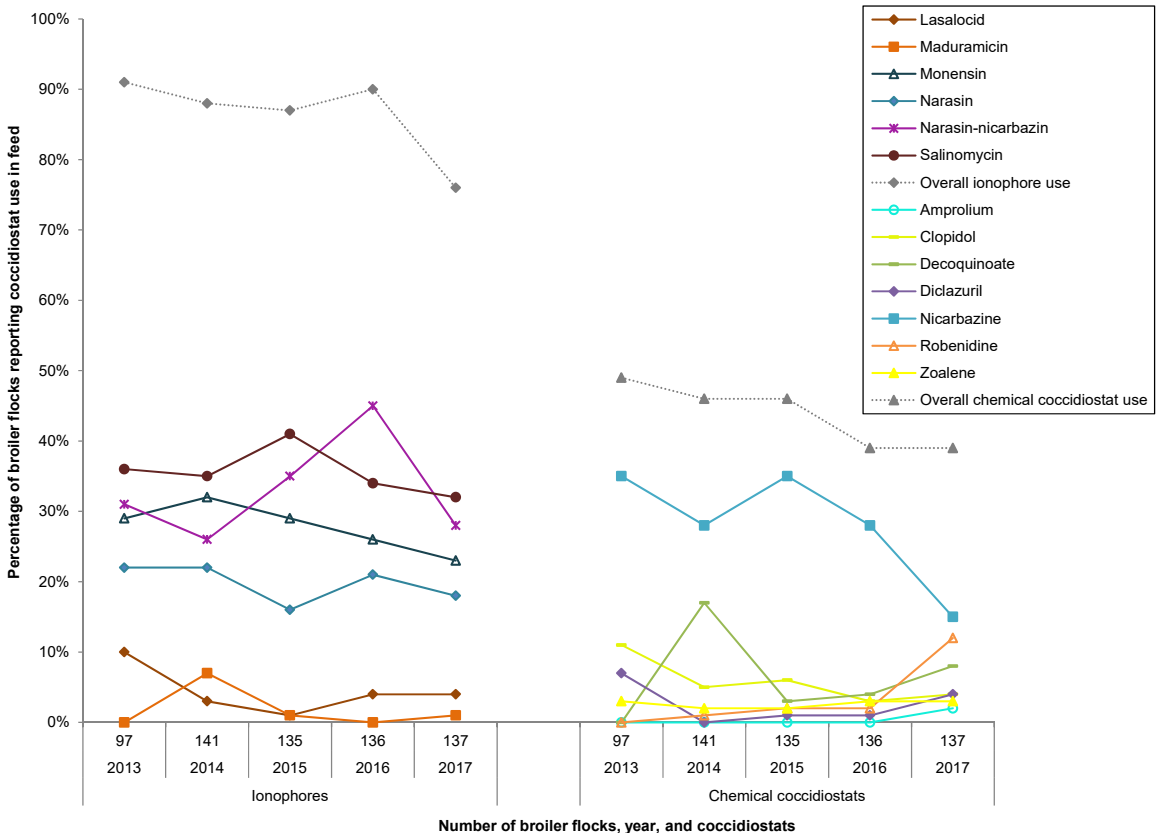
nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Coccidiostat use in feed by frequency

Figure 2. 30 Percentage of broiler flocks reporting coccidiostat use in feed, 2013 to 2017

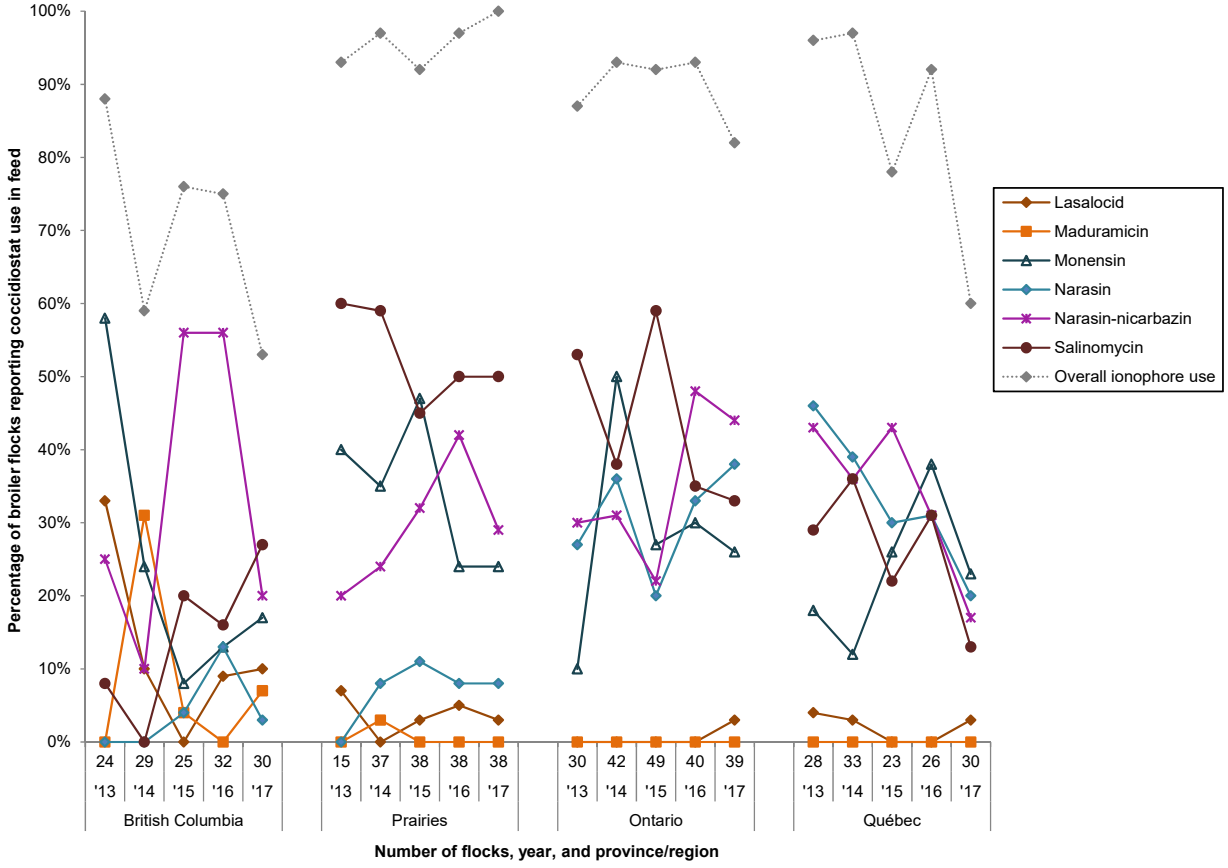


Year		2013	2014	2015	2016	2017
Number of flocks		97	141	135	136	137
Coccidiostat						
IV	Lasalocid	**10%**	3%	1%	**4%**	**4%**
IV	Maduramicin	**0%**	7%	1%	**0%**	**1%**
IV	Monensin	**29%**	32%	29%	**26%**	**23%**
IV	Narasin	**22%**	22%	16%	**21%**	**18%**
IV	Narasin-nicarbazin	**31%**	26%	35%	**45%**	**28%**
IV	Salinomycin	**36%**	35%	41%	**34%**	**32%**
IV	**Overall ionophore use**	**91%**	88%	87%	**90%**	**76%**
N/A	Amprolium	**0%**	0%	0%	**0%**	**2%**
N/A	Clopidol	**11%**	5%	6%	**3%**	**4%**
N/A	Decoquinoate	**0%**	17%	3%	**4%**	**8%**
N/A	Diclazuril	**7%**	0%	1%	**1%**	**4%**
N/A	Nicarbazine	**35%**	28%	35%	**28%**	**15%**
N/A	Robenidine	**0%**	1%	2%	**2%**	**12%**
N/A	Zoalene	**3%**	2%	2%	**3%**	**3%**
N/A	**Overall chemical coccidiostat use**	**49%**	46%	46%	**39%**	**39%**

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. 31 Percentage of broiler flocks reporting ionophore coccidiostats in feed, by province/region, 2013 to 2017



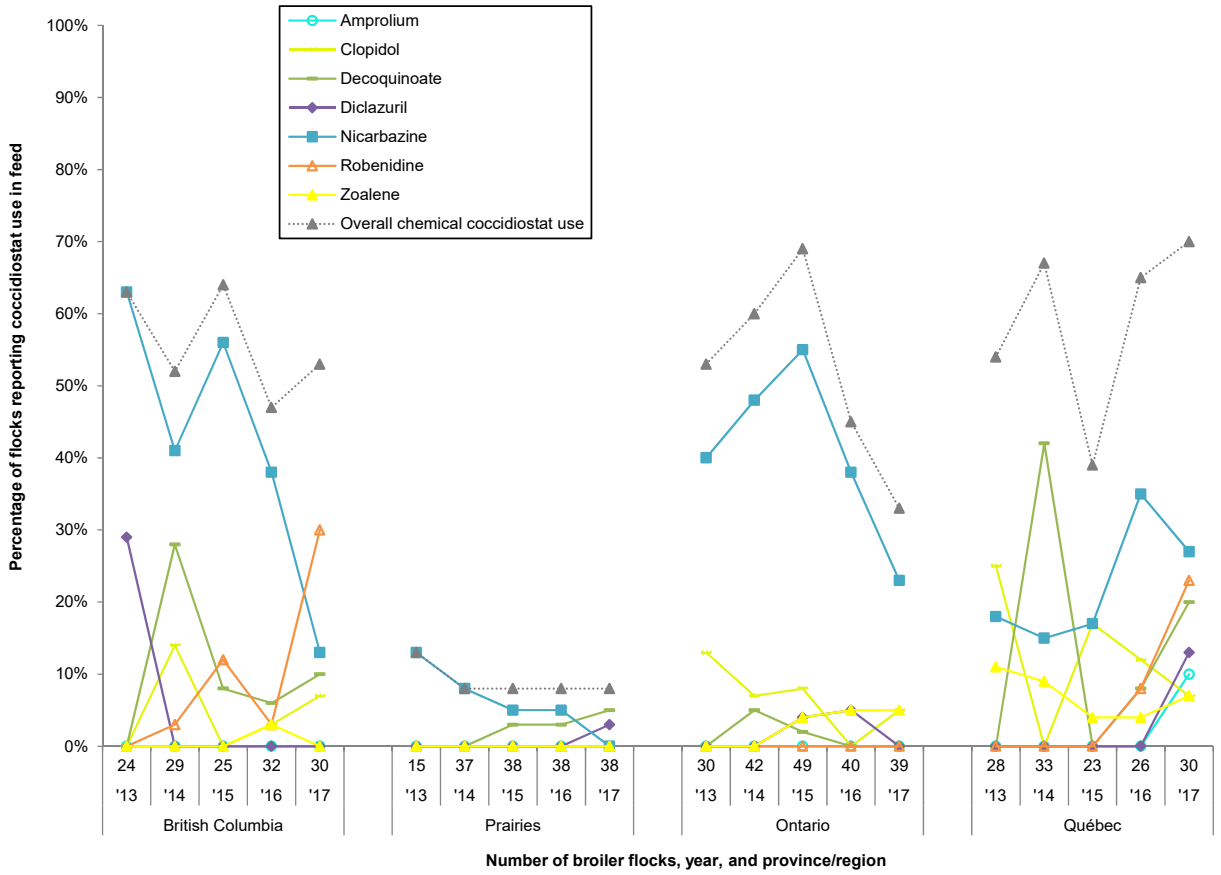
Province/region		British Columbia					Prairies					Ontario					Québec				
Year		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks		24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Coccidiostat																					
	Lasalocid	**33%**	10%	0%	**9%**	**10%**	**7%**	0%	3%	**5%**	**3%**	**0%**	0%	0%	**0%**	**3%**	**4%**	3%	0%	**0%**	**3%**
	Maduramicin	**0%**	31%	4%	**0%**	**7%**	**0%**	3%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
	Monensin	**58%**	24%	8%	**13%**	**17%**	**40%**	35%	47%	**24%**	**24%**	**10%**	50%	27%	**30%**	**26%**	**18%**	12%	26%	**38%**	**23%**
IV	Narasin	**0%**	0%	4%	**13%**	**3%**	**0%**	8%	11%	**8%**	**8%**	**27%**	36%	20%	**33%**	**38%**	**46%**	39%	30%	**31%**	**20%**
	Narasin-nicarbazin	**25%**	10%	56%	**56%**	**20%**	**20%**	24%	32%	**42%**	**29%**	**30%**	31%	22%	**48%**	**44%**	**43%**	36%	43%	**31%**	**17%**
	Salinomycin	**8%**	0%	20%	**16%**	**27%**	**60%**	59%	45%	**50%**	**50%**	**53%**	38%	59%	**35%**	**33%**	**29%**	36%	22%	**31%**	**13%**
	Overall ionophores use	**88%**	59%	76%	**75%**	**53%**	**93%**	97%	92%	**97%**	**100%**	**87%**	93%	92%	**93%**	**82%**	**96%**	97%	78%	**92%**	**60%**

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

For the temporal analyses by 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 (2017 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. 32 Percentage of broiler flocks reporting chemical coccidiostats in feed, by province/region, 2013 to 2017



Province/region		British Columbia					Prairies					Ontario					Québec				
Year		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of flocks		24	29	25	32	30	15	37	38	38	38	30	42	49	40	39	28	33	23	26	30
Coccidiostat																					
N/A	Amprolium	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**10%**
	Clopidol	**0%**	14%	0%	**3%**	**7%**	**0%**	0%	0%	**0%**	**0%**	**13%**	7%	8%	**0%**	**5%**	**25%**	0%	17%	**12%**	**7%**
	Decoquinoate	**0%**	28%	8%	**6%**	**10%**	**0%**	0%	3%	**3%**	**5%**	**0%**	5%	2%	**0%**	**0%**	**0%**	42%	0%	**8%**	**20%**
	Diclazuril	**29%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**3%**	**0%**	0%	4%	**5%**	**0%**	**0%**	0%	0%	**0%**	**13%**
	Nicarbazine	**63%**	41%	56%	**38%**	**13%**	**13%**	8%	5%	**5%**	**0%**	**40%**	48%	55%	**38%**	**23%**	**18%**	15%	17%	**35%**	**27%**
	Robenidine	**0%**	3%	12%	**3%**	**30%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**8%**	**23%**
	Zoalene	**0%**	0%	0%	**3%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	4%	**5%**	**5%**	**11%**	9%	4%	**4%**	**7%**
	Overall chemical coccidiostat use	**63%**	52%	64%	**47%**	**53%**	**13%**	8%	8%	**8%**	**8%**	**53%**	60%	69%	**45%**	**33%**	**54%**	67%	39%	**65%**	**70%**

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

For the temporal analyses by 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 (2017 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. 10 Number of grower-finisher pig herds with reported antimicrobial use by route of administration, 2017

Antimicrobial use	Route of administration			
	Any route[a] n (%)	Feed n (%)	Water n (%)	Injection n (%)
Any antimicrobial use	56 (68)	41 (50)	7 (9)	31 (38)
No antimicrobial use	26 (32)	41 (50)	75 (91)	51 (62)
Total herds	**82 (100)**	**82 (100)**	**82 (100)**	**82 (100)**

[a] Herds with reported use of an antimicrobial class by feed, water, injection, or any combination of these routes are included in each count

Table 2. 11 Number of grower-finisher pigs with reported use of specific active antimicrobial ingredients by route of administration, 2017 (n = 82 herds)

	Antimicrobial class	Antimicrobial	Route of administration			
			Any route[a] n (%)	Feed n (%)	Water n (%)	Injection n (%)
I	Extended-spectrum cephalosporins	Ceftiofur	7 (9)	0 (0)	0 (0)	7 (9)
II	Aminoglycosides	Streptomycin	0 (0)	0 (0)	0 (0)	0 (0)
	Lincosamides	Lincomycin	27 (33)	24 (29)	0 (0)	6 (7)
	Macrolides	Erythromycin	0 (0)	0 (0)	0 (0)	0 (0)
		Tilmicosin	0 (0)	0 (0)	0 (0)	0 (0)
		Tulathromycin	8 (10)	0 (0)	0 (0)	8 (10)
		Tylosin	15 (18)	11 (13)	0 (0)	4 (5)
		Tylvalosin	2 (2)	2 (2)	0 (0)	0 (0)
	Penicillins	Ampicillin	2 (2)	0 (0)	0 (0)	2 (2)
		Penicillin G	22 (27)	5 (6)	4 (5)	16 (20)
	Combination of sulfadoxine and trimethoprime	Trimethoprim-sulfadoxine	8 (10)	0 (0)	1 (1)	7 (9)
	Streptogramins	Virginiamycin	1 (1)	1 (1)	. (0)	0 (0)
III	Aminocyclotols	Spectinomycin	0 (0)	0 (0)	0 (0)	0 (0)
	Aminoglycosides	Neomycin	0 (0)	0 (0)	0 (0)	0 (0)
	Bacitracins	Bacitracin	0 (0)	0 (0)	0 (0)	0 (0)
	Phenicols	Florfenicol	7 (9)	0 (0)	0 (0)	7 (9)
	Pleuromutilins[b]	Tiamulin	6 (7)	5 (6)	0 (0)	1 (1)
	Sulfonamides	Sulfonamide (unspecified)	4 (5)	4 (5)	0 (0)	0 (0)
	Tetracyclines	Chlortetracycline	15 (18)	15 (18)	0 (0)	0 (0)
		Oxytetracycline	3 (4)	0 (0)	2 (2)	3 (4)
		Tetracycline	2 (2)	0 (0)	2 (2)	0 (0)
IV	Flavophospholipids	Bambermycin	2 (2)	2 (2)	0 (0)	0 (0)

Roman numerals I to IV indicate the ranking of antimicrobials based on importance to human medicine as outlined by the Veterinary Drugs Directorate.

[a] Herds with reported use of an antimicrobial class by feed, water, injection, or any combination of these routes are included in each count.

[b] Pleuromutilins are not officially categorized in the current Health Canada Classification System. However, according to the criteria provided by Health Canada, pleuromutilins meet the criteria for Category III.

Table 2. 12 Frequency and quantity of antimicrobial use in grower-finisher pigs, 2017

Route of administration	Antimicrobial	Herds n (%) Total n = 82	Rations n (%) *Total n = 400	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/ PCU	nDDDvetCA/ 1,000 GF pig-days at risk
Feed										
	Lincomycin	24 (29.3)	44 (45)	26 (5 ; 63)	100 (50 ; 100)	66 (23 ; 130)	44 (44 ; 110)	32.6	6.5	57.4
	Penicillin	5 (6.1)	23 (24)	21 (7 ; 63)	100 (100 ; 100)	61 (25 ; 135)	44 (22 ; 110)	12.0	1.7	34.1
II	Tylosin	11 (13.4)	2 (2)	21 (21 ; 21)	100 (100 ; 100)	55 (45 ; 65)	43 (43 ; 43)	0.5	3.9	2.5
	Tylvalosin	2 (2.4)	6 (6)	28 (5 ; 35)	100 (100 ; 100)	38 (23 ; 80)	77 (55 ; 312)	3.7	0.3	14.6
	Virginiamycin	1 (1.2)	4 (4)	28 (28 ; 28)	100 (100 ; 100)	75 (25 ; 125)	250 (250 ; 250)	1.6	0.5	4.2
	Chlortetracycline	15 (18.3)	6 (6)	21 (14 ; 35)	100 (10 ; 100)	39 (23 ; 60)	31 (9 ; 60)	1.5	0.3	2.9
III	Sulfamethazine	4 (4.9)	5 (5)	28 (21 ; 35)	100 (100 ; 100)	39 (23 ; 80)	110 (110 ; 625)	7.3	1.7	14.5
	Tiamulin	5 (6.1)	19 (20)	21 (5 ; 49)	100 (50 ; 100)	38 (22 ; 90)	330 (110 ; 625)	44.9	4.3	37.8
IV	Bambermycin	2 (2.4)	5 (5)	28 (14 ; 49)	100 (100 ; 100)	55 (25 ; 125)	2 (2 ; 2)	0.2		
No AMU in feed		39 (47.6)	183 (65)	28 (7 ; 182)	100 (50 ; 100)	79 (20 ; 280)				
Total Rations (Excluding ionophores)		**43 (52.4)**	**280 (100)**	**28 (5 ; 182)**	**100 (10 ; 100)**	**68 (20 ; 280)**	**55 (2 ; 625)**	**104.3**	**19.2**	**168.1**

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 2016 CIPARS Annual Report, 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.

nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed metric description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

[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; the final mg/PCU, nDDDvetCA/1,000 GF pig-days at risk and nDDDvetCA/PCU exclude coccidiostats and pyrimethamine. Flavophospholipids was included only in the mg/PCU.

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

Table 2. 13 Production, biomass and quantity of antimicrobials used in feed by province/region, 2012 to 2017 (this analysis excludes ionophores)

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/ PCU		nDDDvetCA/ 1,000 GF pig-days at risk	
		Total	Total	%	(kg)	(Days)	(mg)	(kg)	Total	% change[b]	Total	% change[b]	Total	% change[b]
Prairies	2013	38	172	61	69 (23 ; 122)	109	734,172,951	5,084,913	144		35		320	
	2014	43	205	61	68 (25 ; 118)	109	842,082,712	5,075,220	166	15	33	-6	301	-6
	2015	39	165	53	70 (25 ; 121)	111	854,877,885	5,493,810	156	-6	29	-13	257	-15
	2016	40	176	49	69 (28 ; 136)	112	548,609,650	5,438,142	101	-35	23	-20	205	-20
	2017	40	151	29	68 (23 ; 215)	111	562,073,067	5,359,508	105	4	18	-21	163	-20
Ontario	2013	28	100	47	70 (26 ; 125)	108	232,737,107	2,205,947	106		20		182	
	2014	26	109	54	70 (27 ; 125)	110	358,536,769	2,378,448	151	43	28	45	258	42
	2015	25	96	51	70 (27 ; 125)	114	454,971,382	2,306,070	197	31	37	30	322	25
	2016	27	95	51	63 (28 ; 125)	114	298,836,760	2,422,905	123	-37	22	-39	196	-39
	2017	22	87	54	70 (30 ; 125)	110	189,631,838	1,333,670	142	15	28	23	250	28
Québec	2013	23	69	65	67 (25 ; 121)	113	322,619,063	1,516,190	213		30		266	
	2014	26	79	73	63 (25 ; 118)	121	393,818,303	2,232,588	176	-17	31	2	255	-4
	2015	21	67	75	58 (22 ; 119)	115	393,836,556	1,864,200	211	20	31	0	268	5
	2016	24	52	48	59 (25 ; 120)	117	262,132,293	1,744,568	150	-29	19	-38	165	-38
	2017	20	59	39	63 (30 ; 123)	125	135,113,791	1,809,600	75	-50	16	-15	131	-21
National[c]	2013	89	341	58	68 (23 ; 125)	110	1,289,529,122	8,807,050	146		30		276	
	2014	95	393	62	68 (25 ; 125)	112	1,594,437,784	9,686,255	165	12	31	4	278	1
	2015	85	328	57	67 (22 ; 125)	113	1,703,685,823	9,664,080	176	7	31	-1	274	-2
	2016	91	323	49	67 (25 ; 136)	114	1,109,578,703	9,605,614	116	-34	22	-29	194	-29
	2017	82	297	38	68 (23 ; 215)	114	886,818,695	8,502,778	104	-10	19	-13	168	-13

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 2016 CIPARS Annual Report, 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.

nDDDvet/PCU = number of DDDvetCA/population correction unit.

For detailed metric description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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. 14 Frequency and quantity of coccidiostat use in grower-finisher pigs, 2017

Route of administration	Antimicrobial	Herds n (%) Total n = 82	Rations n (%) Total n = 400	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	8 (10)	31 (9)	35 (11, 63)	100 (50, 100)	70 (21, 130)	15 (15, 70)	7.2
	Salinomycin	10 (12)	32 (9)	28 (7, 84)	100 (50, 100)	78 (27, 135)	25 (15, 42)	14.2
No AMU in feed		37 (45)	181 (51)	28 (7, 182)	100 (50, 100)	79 (20, 280)		
Total rations		**82 (100)**	**358 (100)**	**28 (5, 182)**	**100 (10, 100)**	**70 (20, 280)**	**44 (2, 625)**	**125.8**

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 metric description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

[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[7], adjusted for herd average daily gain; only rations medicated with the specific antimicrobial were included in this analysis.

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

Table 2. 15 Production, biomass and quantity of ionophore coccidiostats used in feed by province/region, 2012 to 2017

Province/ region	Year	Number of herds	Number of rations	Proportion of rations medicated	Average weight at exposure median (min ; max)	Active ingredient	Average grow-finish period	Grower-finisher pig weights[a]	mg/PCU	
		Total	Total	n (%)	(kg)	(mg)	(Days)	(kg)	Total	% change[b]
Prairies	2013	7 (18)	197	25 (13)	77 (35; 113)	88,071,500	109	5,084,913	17	
	2014	9 (21)	231	26 (11)	69 (26; 113)	68,166,364	109	5,075,220	13	-22
	2015	10 (26)	204	39 (19)	70 (29; 118)	95423770*	111	5,493,810	17*	29*
	2016	6 (15)	201	25 (12)	70 (30; 118)	99,004,624	112	5,438,142	18	5
	2017	7 (18)	179	28 (16)	74 (32; 118)	127,822,238	111	5,359,508	24	31
Ontario	2013	2 (7)	107	7 (7)	75 (48; 103)	8,511,640	108	2,205,947	4	
	2014	0 (0)	109	0 (0)	0 (0; 0)	0	110	2,378,448	0	0
	2015	3 (12)	105	9 (9)	70 (43; 107)	16,760,072	114	2,306,070	7	
	2016	4 (15)	105	10 (10)	74 (35; 106)	24,535,301	114	2,422,905	10	39
	2017	2 (9)	92	5 (5)	88 (53; 113)	11,309,951	110	1,333,670	8	-16
Québec	2013	9 (39)	98	29 (30)	78 (38; 115)	63,919,053	113	1,516,190	42	
	2014	13 (50)	116	37 (32)	70 (35; 119)	88,321,296	121	2,232,588	40	-6
	2015	8 (38)	92	25 (27)	80 (30; 115)	89,069,930	115	1,864,200	48	21
	2016	14 (58)	96	44 (46)	80 (30; 120)	108,368,724	117	1,744,568	62	30
	2017	9 (45)	90	31 (34)	75 (33; 115)	43,375,641	125	1,809,600	24	-61
National[c]	2013	18 (20)	402	61 (15)	77 (35; 115)	160,502,194	110	8,807,050	18	
	2014	22 (23)	456	63 (14)	70 (26; 119)	156,487,660	112	9,686,255	16	-11
	2015	21 (25)	401	73 (18)	75 (29; 118)	201253771*	113	9,664,080	21*	28*
	2016	24 (26)	402	79 (20)	78 (30; 120)	231,908,649	114	9,605,614	24	16
	2017	18 (22)	361	64 (18)	75 (32; 118)	182,507,830	114	8,502,778	21	-11

mg/PCU = milligrams/population correction unit.

For detailed metric description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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.

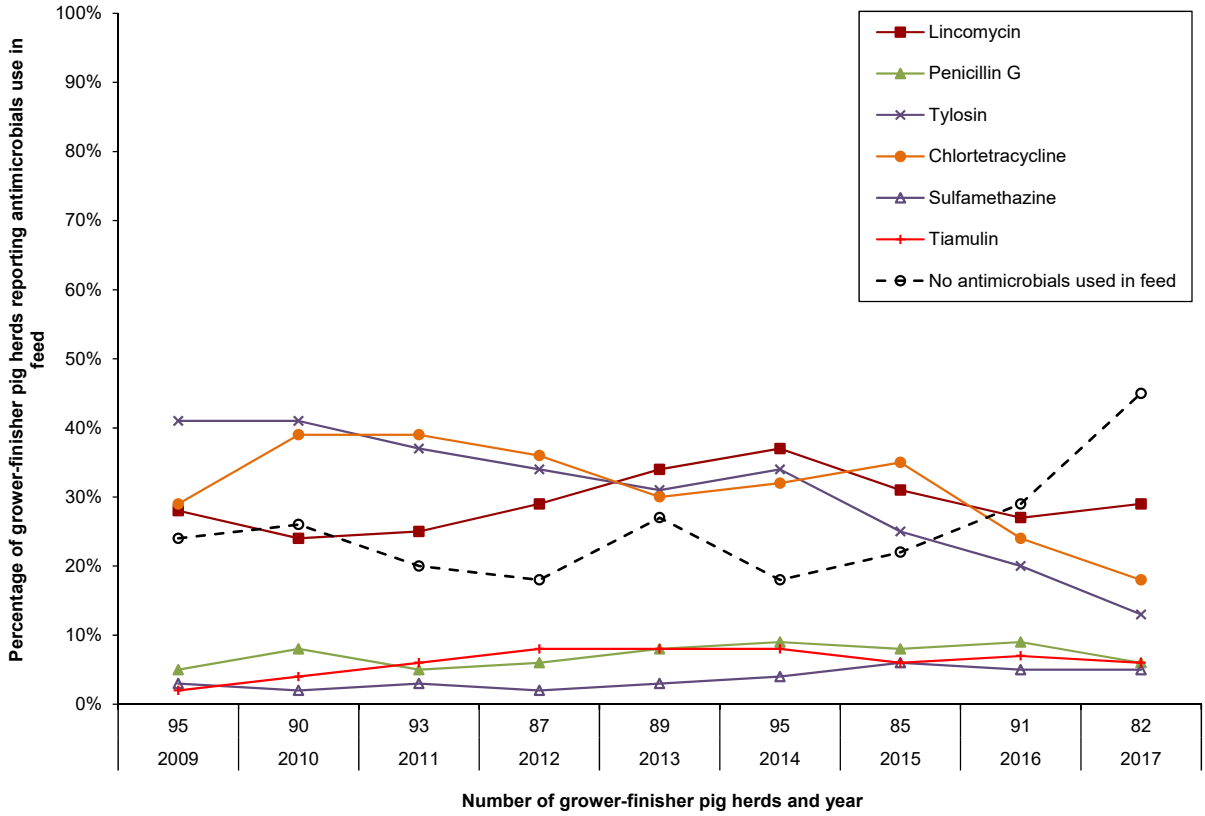
[a] Population correction unit (PCU) or biomass, European weight (total herd population x ESVAC standard pig weight of 65 kilograms).

[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. 33 Percentage of pig herds reporting antimicrobial use in feed, 2009 to 2017



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

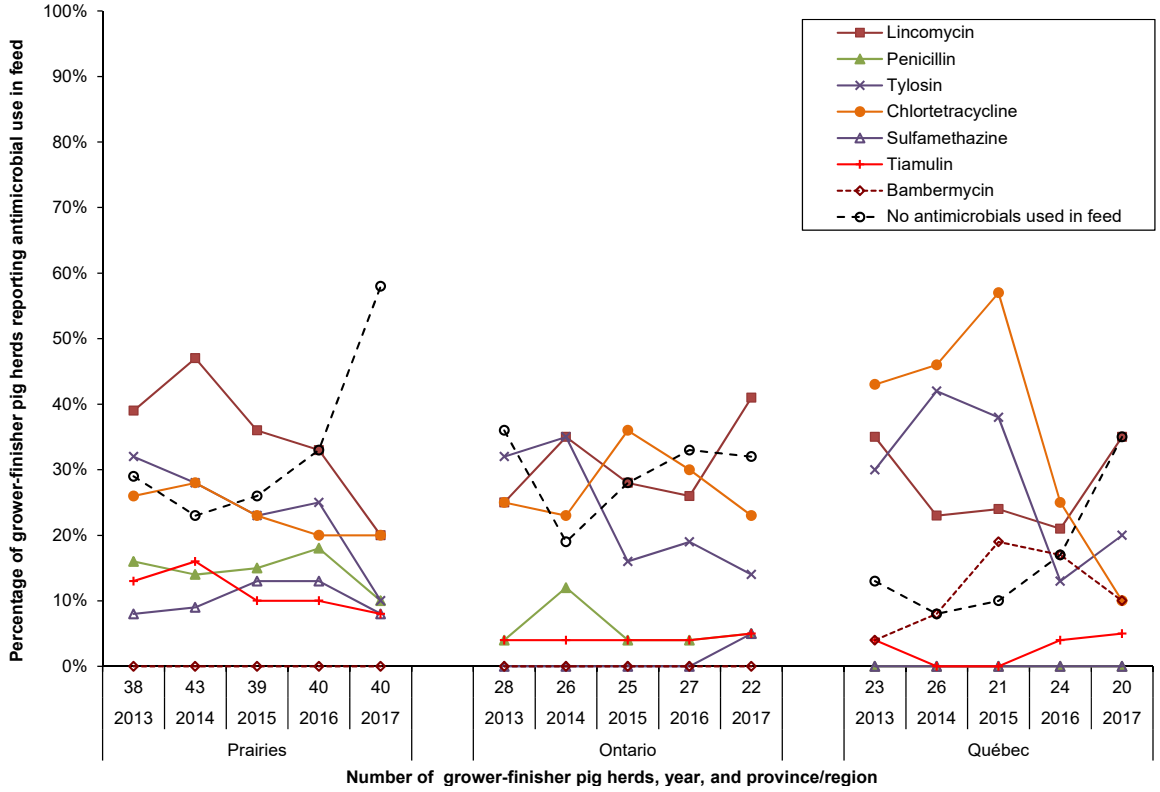
Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

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, tylvalosin, 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. 34 Percentage of pig herds reporting antimicrobial use in feed by province/region, 2013 to 2017



Province/region		Prairies					Ontario					Québec				
Year		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of herds		38	43	39	40	40	28	26	25	27	22	23	26	21	24	20
Antimicrobial																
	Lincomycin	**39%**	47%	36%	**33%**	**20%**	**25%**	35%	28%	**26%**	**41%**	**35%**	23%	24%	**21%**	**35%**
II	Penicillin	**16%**	14%	15%	**18%**	**10%**	**4%**	12%	4%	**4%**	**5%**	**0%**	0%	0%	**0%**	**0%**
	Tylosin	**32%**	28%	23%	**25%**	**10%**	**32%**	35%	16%	**19%**	**14%**	**30%**	42%	38%	**13%**	**20%**
	Chlortetracycline	**26%**	28%	23%	**20%**	**20%**	**25%**	23%	36%	**30%**	**23%**	**43%**	46%	57%	**25%**	**10%**
III	Sulfamethazine	**8%**	9%	13%	**13%**	**8%**	**0%**	0%	0%	**0%**	**5%**	**0%**	0%	0%	**0%**	**0%**
	Tiamulin	**13%**	16%	10%	**10%**	**8%**	**4%**	4%	4%	**4%**	**5%**	**4%**	0%	0%	**4%**	**5%**
IV	Bambermycin	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**4%**	8%	19%	**17%**	**10%**
	No antimicrobials used in feed	**29%**	23%	26%	**33%**	**58%**	**36%**	19%	28%	**33%**	**32%**	**13%**	8%	10%	**17%**	**35%**

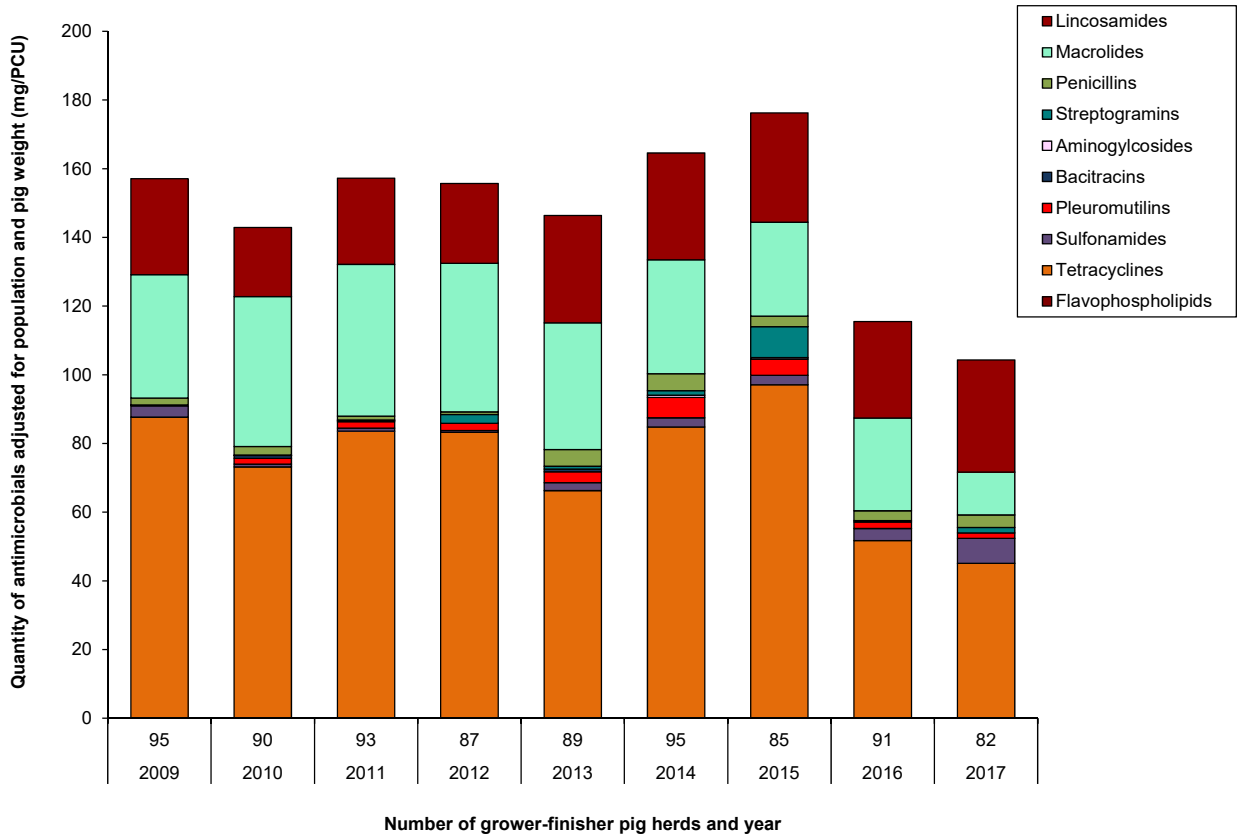
Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

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, tylvalosin and virginiamycin; Category III: bacitracin, neomycin, oxytetracycline, spectinomycin, and tiamulin.

For the temporal analyses by 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 (2017 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given antimicrobial.

Antimicrobial use in feed by quantitative indicators

Figure 2. 35 Quantity of antimicrobial use in feed, adjusted for population and pig weight (mg/PCU), 2009 to 2017



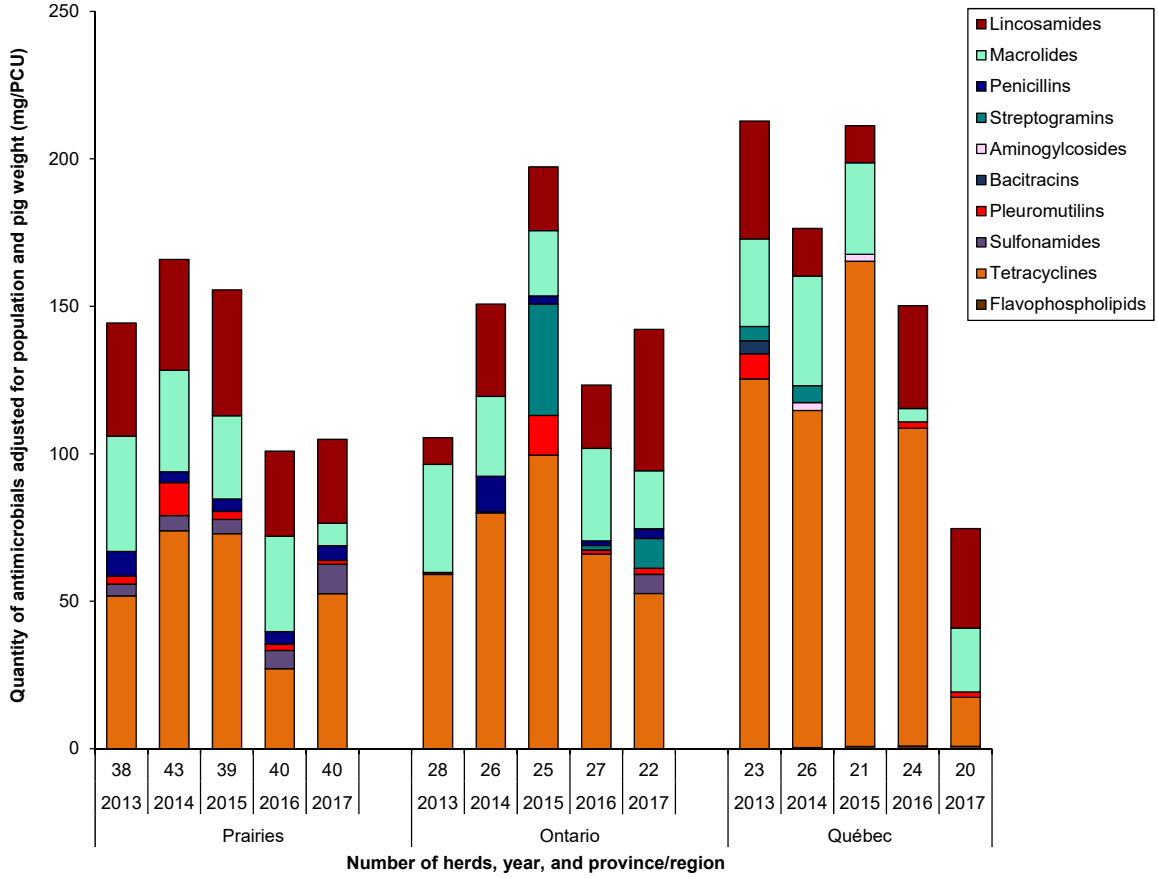
Year	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of herds	95	90	93	87	89	95	85	91	82
Antimicrobial class									
II Lincosamides	28.0	20.1	25.1	23.2	31.3	31.1	31.9	28.1	32.6
II Macrolides	35.9	43.7	44.2	43.3	36.8	33.2	27.3	27.0	12.5
II Penicillins	2.0	2.5	1.2	0.8	4.9	4.9	3.0	2.9	3.7
II Streptogramins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

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 description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Figure 2. 36 Quantity of antimicrobial use in feed, adjusted for population and pig weight (mg/PCU), by province/region, 2013 to 2017



Province/region	Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of herds	38	43	39	40	40	28	26	25	27	22	23	26	21	24	20
Antimicrobial class															
II Lincosamides	38	38	43	29	28	9	31	22	21	48	40	16	13	35	34
II Macrolides	39	34	28	32	8	37	27	22	31	20	30	37	31	5	22
II Penicillins	8	4	4	4	5	< 1	12	3	2	3	0	0	0	0	0
II Streptogramins	0	0	0	0	0	0	0	38	2	10	5	6	0	0	0
III Aminoglycosides	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0
III Bacitracins	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
III Pleuromutilins	3	11	3	2	1	1	0	13	1	2	8	0	0	2	2
III Sulfonamides	4	5	5	6	10	0	0	0	0	7	0	0	0	0	0
III Tetracyclines	52	74	73	27	53	59	80	100	66	53	125	114	165	108	17
IV Flavophospholipids	0	0	0	0	0	0	0	0	0	0	< 1	< 1	1	1	1
Total	**144**	**166**	**156**	**101**	**105**	**106**	**151**	**197**	**123**	**142**	**213**	**176**	**211**	**150**	**75**

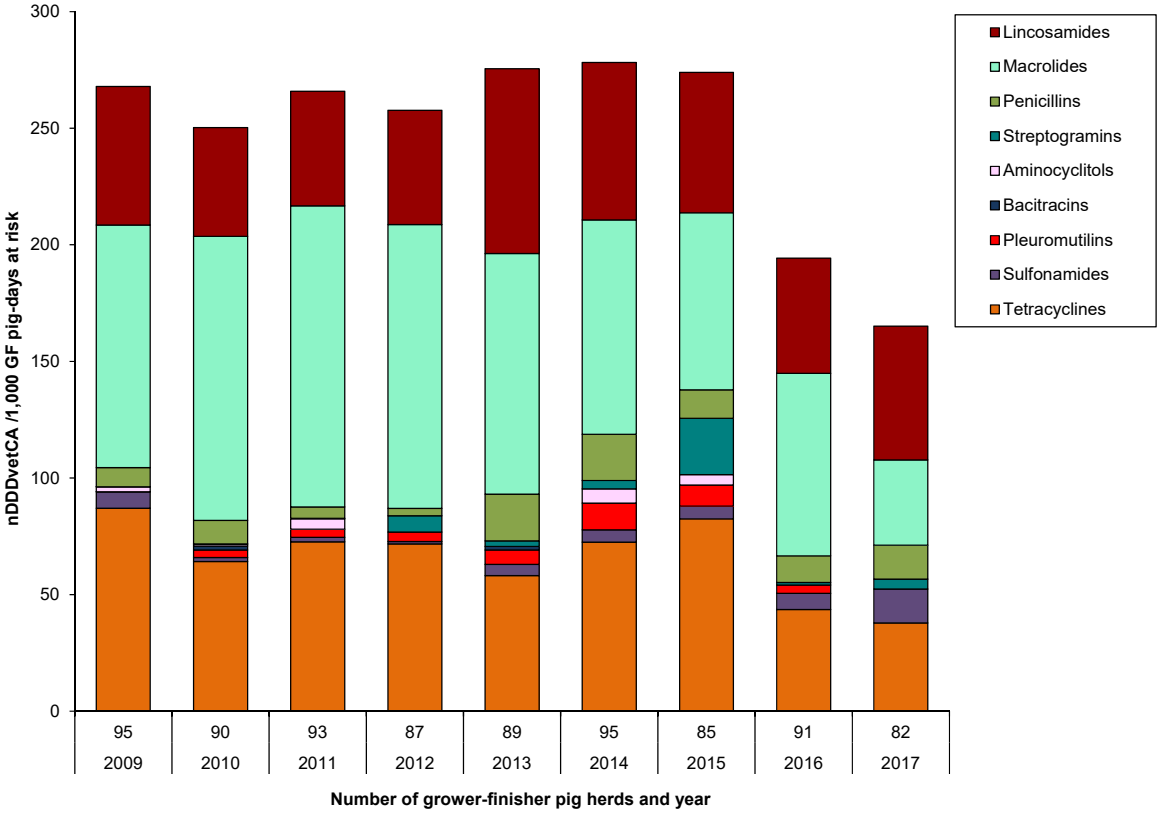
Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

mg/PCU = milligrams/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Figure 2. 37 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 2017



Year		2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of herds		95	90	93	87	89	95	85	91	82
Antimicrobial										
II	Lincosamides	59	47	49	49	79	68	60	49	57
	Macrolides	104	122	129	122	103	92	76	78	37
	Penicillins	8	10	5	3	20	20	12	11	15
	Streptogramins	0	< 1	< 1	7	2	4	24	1	4
III	Aminocyclitols	2	1	4	0	0	6	4	0	0
	Bacitracins	0	2	0	0	2	0	0	0	0
	Pleuromutilins	< 1	3	4	4	6	11	9	4	0
	Sulfonamides	7	2	2	1	5	5	5	7	15
	Tetracyclines	87	64	73	72	58	72	82	44	38
Total		**268**	**250**	**266**	**258**	**276**	**278**	**274**	**194**	**168**

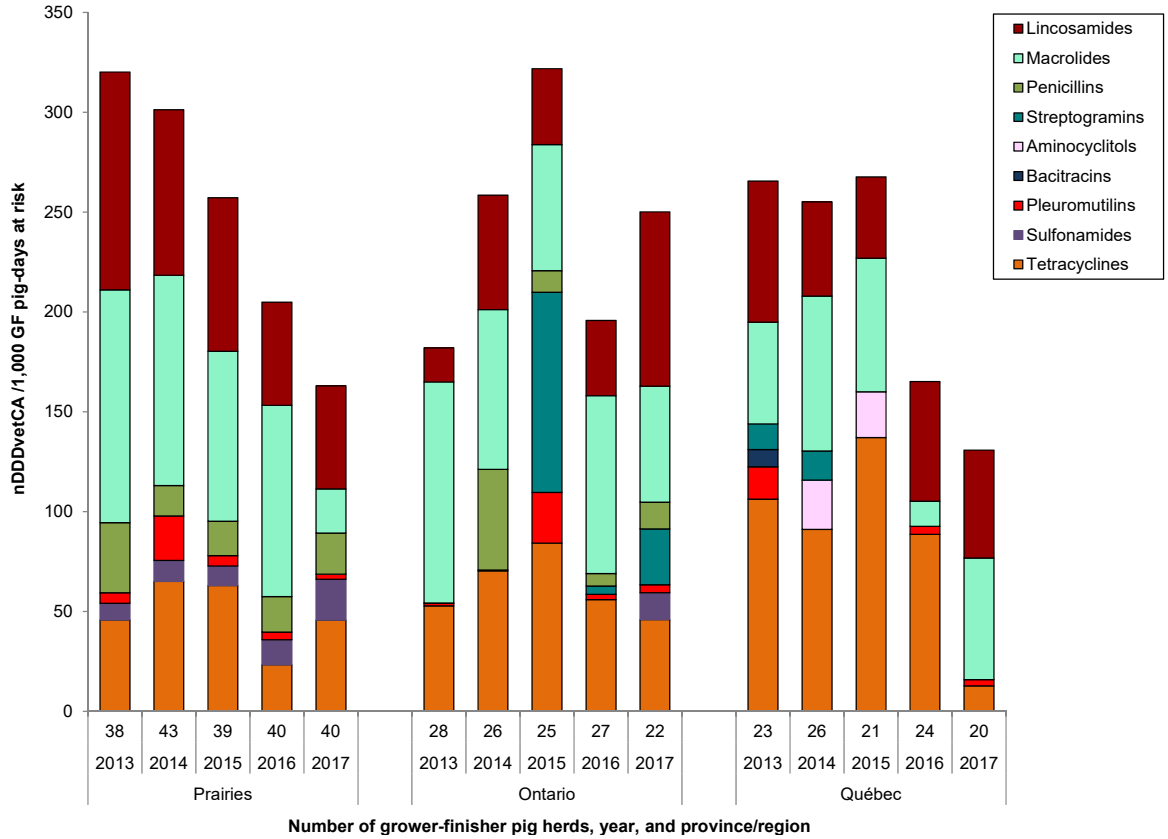
Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

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 2016 CIPARS Annual Report, 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 description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Figure 2. 38 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, 2012 to 2017



Province/region		Prairies					Ontario					Québec				
Year		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of herds		38	43	39	40	40	28	26	25	27	22	23	26	21	24	20
Antimicrobial class																
II	Lincosamides	109	83	77	52	52	17	57	38	38	87	71	47	41	60	54
II	Macrolides	117	105	85	96	22	111	80	63	89	58	51	78	67	13	61
II	Penicillins	35	15	17	18	21	0	50	11	6	13	0	0	0	0	0
II	Streptogramins	0	0	0	0	0	0	0	100	4	28	13	15	0	0	0
III	Aminocyclitols	0	0	0	0	0	0	0	0	0	0	0	25	23	0	0
III	Bacitracins	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0
III	Pleuromutilins	5	22	5	4	3	1	1	25	3	4	16	0	0	4	3
III	Sulfonamides	8	11	10	12	20	0	0	0	0	13	0	0	0	0	0
III	Tetracyclines	46	65	63	23	46	53	70	84	56	46	106	91	137	89	13
Total		**320**	**301**	**257**	**205**	**163**	**182**	**258**	**322**	**196**	**250**	**266**	**255**	**268**	**165**	**131**

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

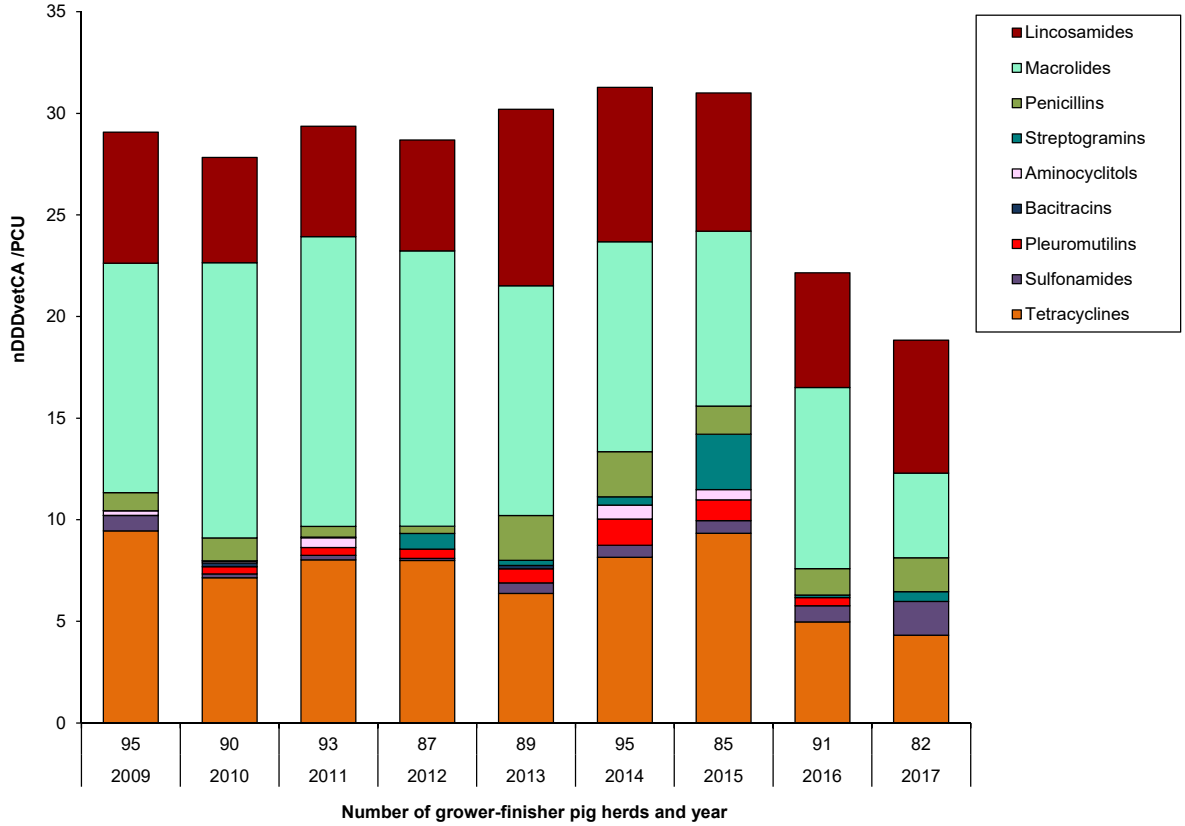
DDDvetCA = Canadian Defined Daily Doses (average labelled dose) in milligrams per kilogram grower-finisher pig weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2016 CIPARS Annual Report, Table A. 2 for the list of standards.

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

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Figure 2. 39 Number of Canadian Defined Daily Doses for animals per population correction unit (nDDDvetCA/PCU) for antimicrobials administered in feed, 2009 to 2017



Year Number of herds		2009 95	2010 90	2011 93	2012 87	2013 89	2014 95	2015 85	2016 91	2017 82
Antimicrobial class										
II	Lincosamides	6	5	5	5	9	8	7	6	7
	Macrolides	11	14	14	14	11	10	9	9	4
	Penicillins	1	1	1	0	2	2	1	1	2
	Streptogramins	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
III	Aminocyclitols	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
	Bacitracins	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
	Pleuromutilins	< 1	< 1	< 1	< 1	< 1	1	1	< 1	< 1
	Sulfonamides	1	< 1	< 1	< 1	< 1	< 1	< 1	1	2
	Tetracyclines	9	7	8	8	6	8	9	5	4
Total		**29**	**28**	**29**	**29**	**30**	**31**	**31**	**22**	**19**

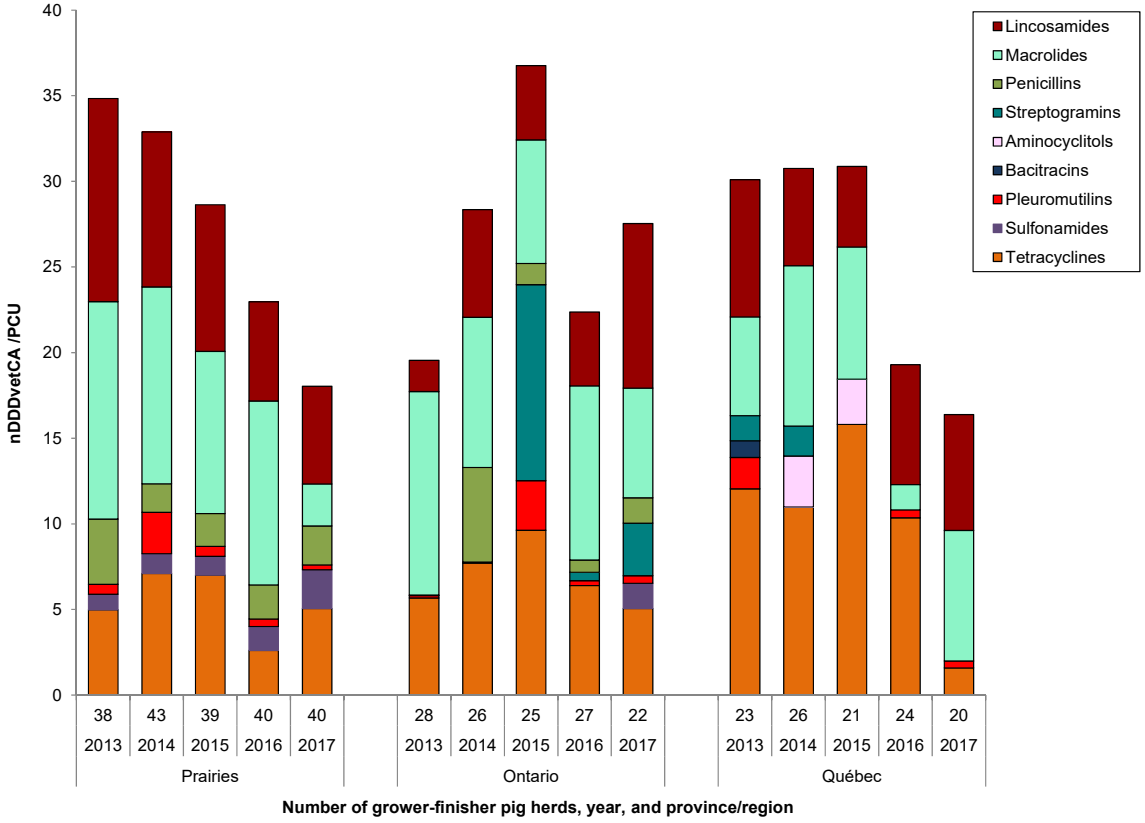
Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

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 2016 CIPARS Annual Report, Table A. 2 for the list of standards.

nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Figure 2. 40 Number of Canadian Defined Daily Doses for animals per population correction unit (DDDvetCA/PCU) for antimicrobials administered in feed, by province/region, 2012 to 2017



Province/region		Prairies					Ontario					Québec				
Year		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of herds		38	43	39	40	40	28	26	25	27	22	23	26	21	24	20
Antimicrobial class																
II	Lincosamides	12	9	9	6	6	2	6	4	4	10	8	6	5	7	7
II	Macrolides	13	11	9	11	2	12	9	7	10	6	6	9	8	1	8
II	Penicillins	4	2	2	2	2	0	6	1	1	1	0	0	0	0	0
II	Streptogramins	0	0	0	0	0	0	0	11	0	3	1	2	0	0	0
III	Aminocyclitols	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
III	Bacitracins	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
III	Pleuromutilins	1	2	1	0	0	0	0	3	0	0	2	0	0	0	0
III	Sulfonamides	1	1	1	1	2	0	0	0	0	1	0	0	0	0	0
III	Tetracyclines	5	7	7	3	5	6	8	10	6	5	12	11	16	10	2
Total		**35**	**33**	**29**	**23**	**18**	**20**	**28**	**37**	**22**	**28**	**30**	**31**	**31**	**19**	**16**

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 2016 CIPARS Annual Report, Table A. 2 for the list of standards.

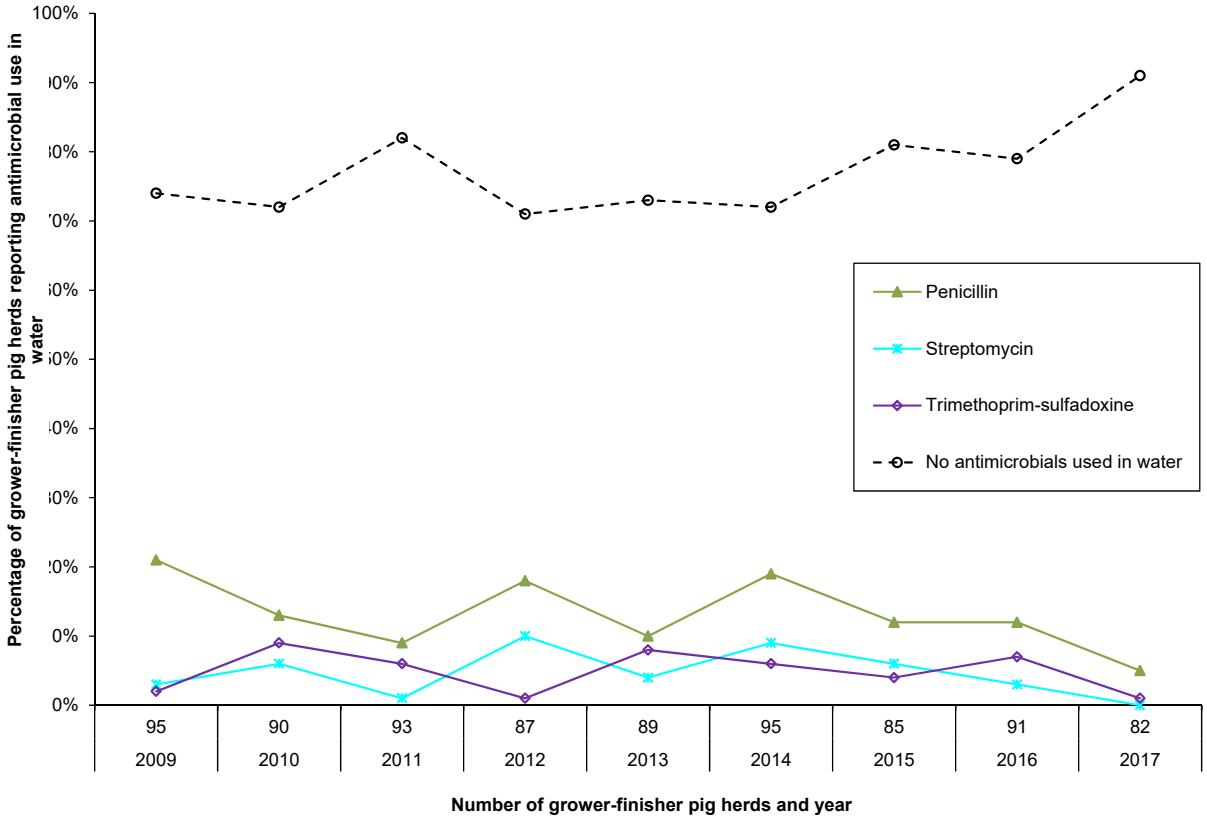
nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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

Antimicrobial use in water by frequency

Figure 2. 41 Percentage of pig herds reporting antimicrobial use in water, 2009 to 2017



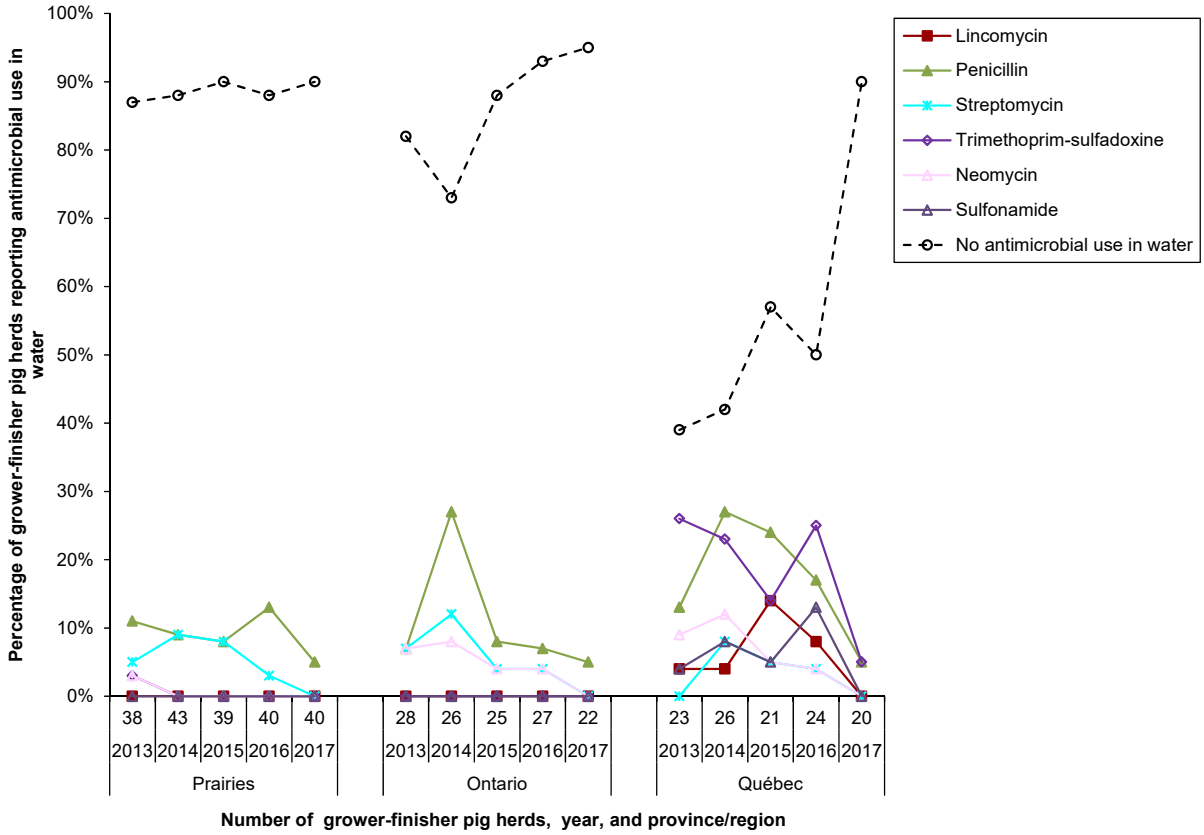
Year Number of herds	2009 95	2010 90	2011 93	2012 87	2013 89	2014 95	2015 85	2016 91	2017 82
Antimicrobial									
II Penicillin	**21%**	13%	9%	18%	10%	19%	12%	**12%**	**5%**
II Streptomycin	**3%**	6%	1%	10%	4%	9%	6%	**3%**	**0%**
II Trimethoprim-sulfadoxine	**2%**	9%	6%	1%	8%	6%	4%	**7%**	**1%**
No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

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. 42 Percentage of pig herds reporting antimicrobial use in water by province/region, 2013 to 2017



Province/region	Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of herds	38	43	39	40	40	28	26	25	27	22	23	26	21	24	20
Antimicrobial															
II Lincomycin	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**4%**	4%	14%	**8%**	**0%**
Penicillin	**11%**	9%	8%	**13%**	**5%**	**7%**	27%	8%	**7%**	**5%**	**13%**	27%	24%	**17%**	**5%**
Streptomycin	**5%**	9%	8%	**3%**	**0%**	**7%**	12%	4%	**4%**	**0%**	**0%**	8%	5%	**4%**	**0%**
Trimethoprim-sulfadoxine	**3%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**26%**	23%	14%	**25%**	**5%**
III Neomycin	**3%**	0%	0%	**0%**	**0%**	**7%**	8%	4%	**4%**	**0%**	**9%**	12%	5%	**4%**	**0%**
Sulfonamide	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**4%**	8%	5%	**13%**	**0%**
No antimicrobial use in water	**87%**	88%	90%	**88%**	**90%**	**82%**	73%	88%	**93%**	**95%**	**39%**	42%	57%	**50%**	**90%**

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

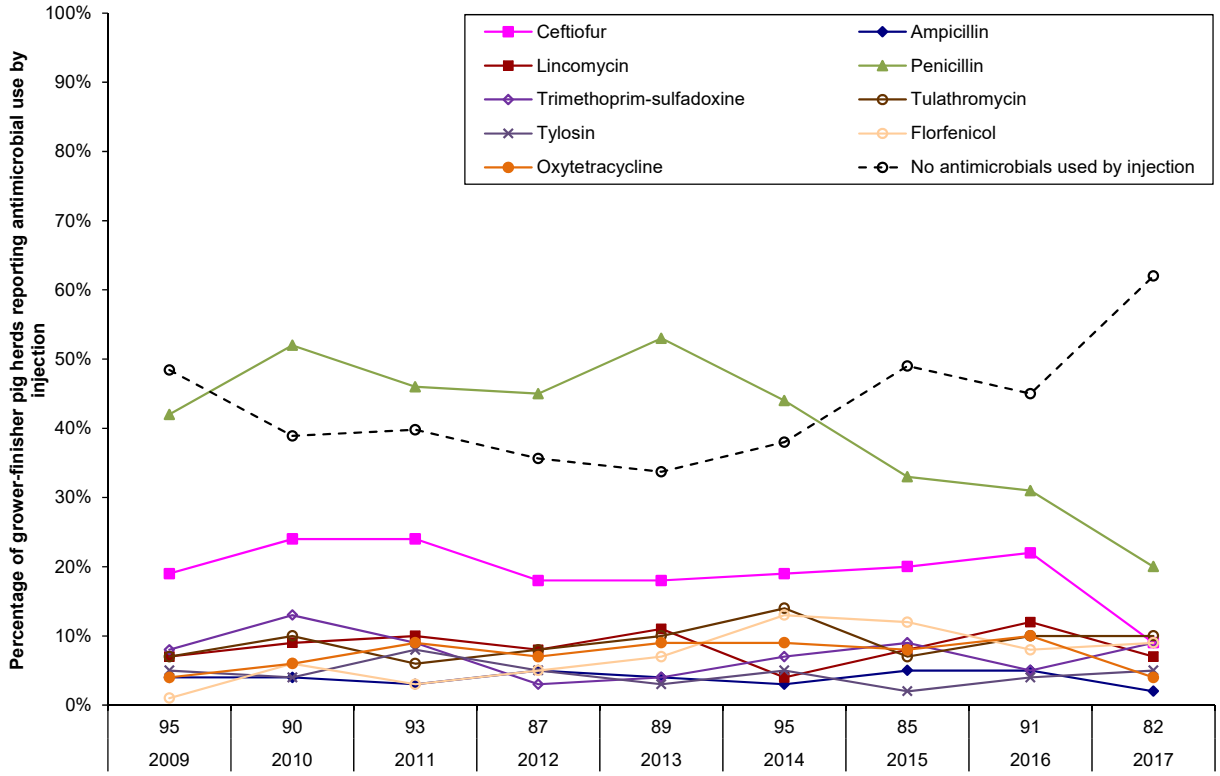
Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure. Antimicrobial use in water reported by fewer than 5% of herds included Category III: spectinomycin and tetracycline.

For the temporal analyses by 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 (2017 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 frequency

Figure 2. 43 Percentage of pig herds reporting antimicrobial use by injection, 2009 to 2017



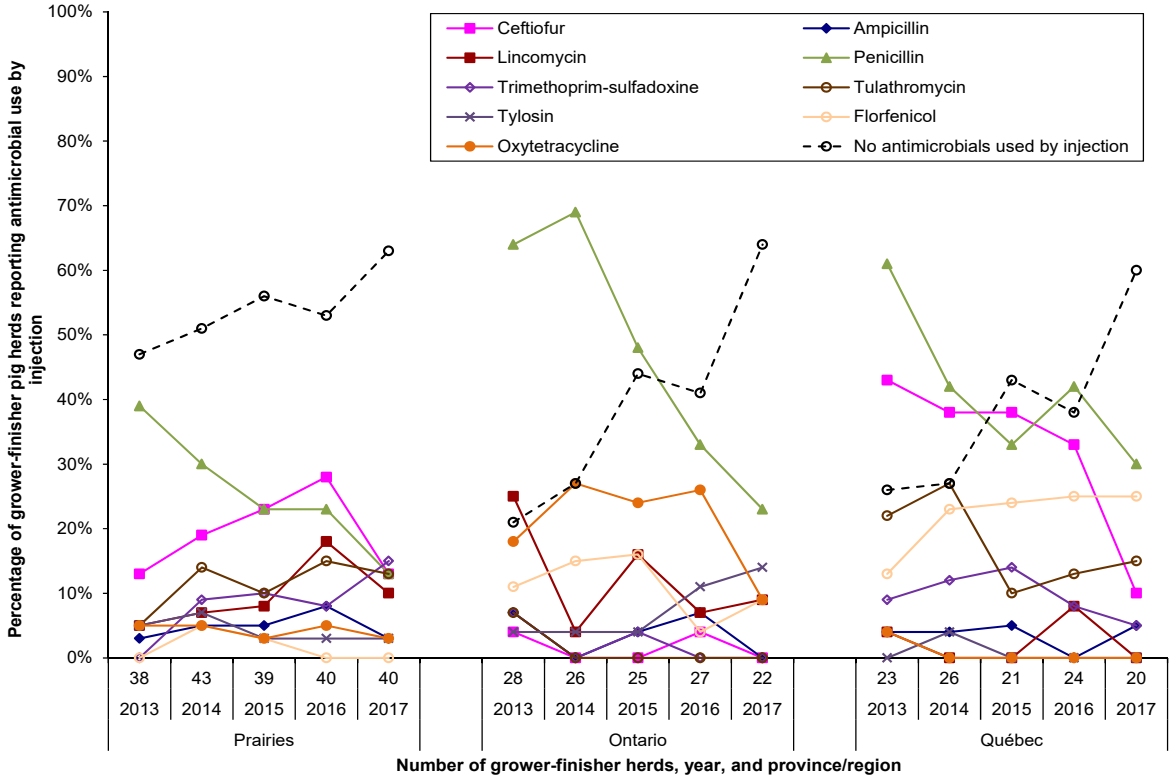
Year Number of herds	2009 95	2010 90	2011 93	2012 87	2013 89	2014 95	2015 85	2016 91	2017 82
Antimicrobial									
I Ceftiofur	**20%**	24%	24%	18%	18%	19%	20%	**22%**	**9%**
Ampicillin	**4%**	4%	3%	5%	4%	3%	5%	**5%**	**2%**
Lincomycin	**8%**	9%	10%	8%	11%	4%	8%	**12%**	**7%**
II Penicillin	**41%**	51%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

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. 44 Percentage of pig herds reporting antimicrobial use by injection, by province/region, 2013 to 2017



Province/region	Prairies					Ontario					Québec				
Year	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of herds	38	43	39	40	40	28	26	25	27	22	23	26	21	24	20
Antimicrobial															
I Ceftiofur	**13%**	19%	23%	**28%**	**13%**	**4%**	0%	0%	**4%**	**0%**	**43%**	38%	38%	**33%**	**10%**
II Ampicillin	**3%**	5%	5%	**8%**	**3%**	**7%**	0%	4%	**7%**	**0%**	**4%**	4%	5%	**0%**	**5%**
II Lincomycin	**5%**	7%	8%	**18%**	**10%**	**25%**	4%	16%	**7%**	**9%**	**4%**	0%	0%	**8%**	**0%**
II Penicillin	**39%**	30%	23%	**23%**	**13%**	**64%**	69%	48%	**33%**	**23%**	**61%**	42%	33%	**42%**	**30%**
II Trimethoprim-sulfadoxine	**0%**	9%	10%	**8%**	**15%**	**7%**	0%	4%	**0%**	**0%**	**9%**	12%	14%	**8%**	**5%**
II Tulathromycin	**5%**	14%	10%	**15%**	**13%**	**7%**	0%	0%	**0%**	**0%**	**22%**	27%	10%	**13%**	**15%**
II Tylosin	**5%**	7%	3%	**3%**	**3%**	**4%**	4%	4%	**11%**	**14%**	**0%**	4%	0%	**0%**	**0%**
III Florfenicol	**0%**	5%	3%	**0%**	**0%**	**11%**	15%	16%	**4%**	**9%**	**13%**	23%	24%	**25%**	**25%**
III Oxytetracycline	**5%**	5%	3%	**5%**	**3%**	**18%**	27%	24%	**26%**	**9%**	**4%**	0%	0%	**0%**	**0%**
No antimicrobials used by injection	**47%**	51%	56%	**53%**	**63%**	**21%**	27%	44%	**41%**	**64%**	**26%**	27%	43%	**38%**	**60%**

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

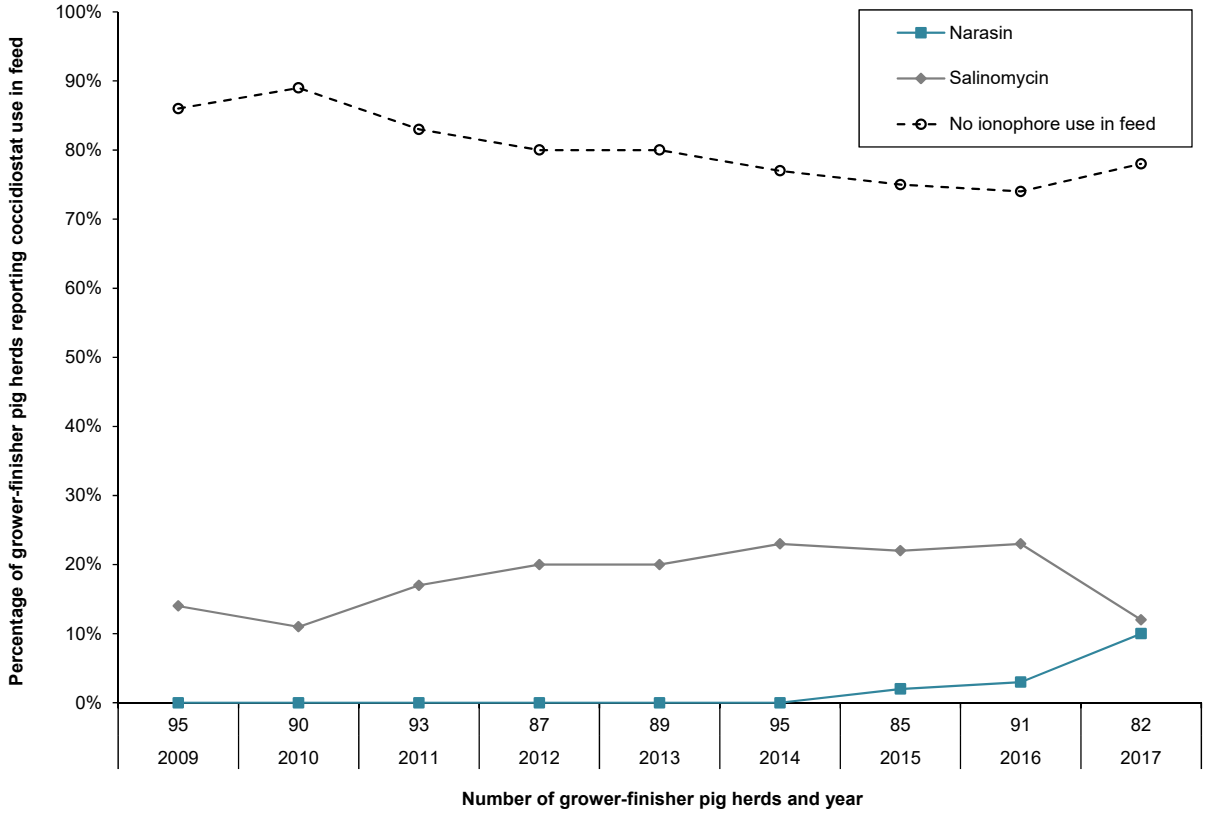
Only antimicrobials used by 5% of herds or more in a given year within any province/region are depicted in this figure. Antimicrobial use by injection reported by fewer than 5% of herds included Category II: erythromycin; Category III: spectinomycin and tiamulin.

For the temporal analyses, 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 (2017 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.

Coccidiostat use in feed by frequency

Figure 2. 45 Percentage of pig herds reporting ionophore coccidiostat use in feed, 2009 to 2017

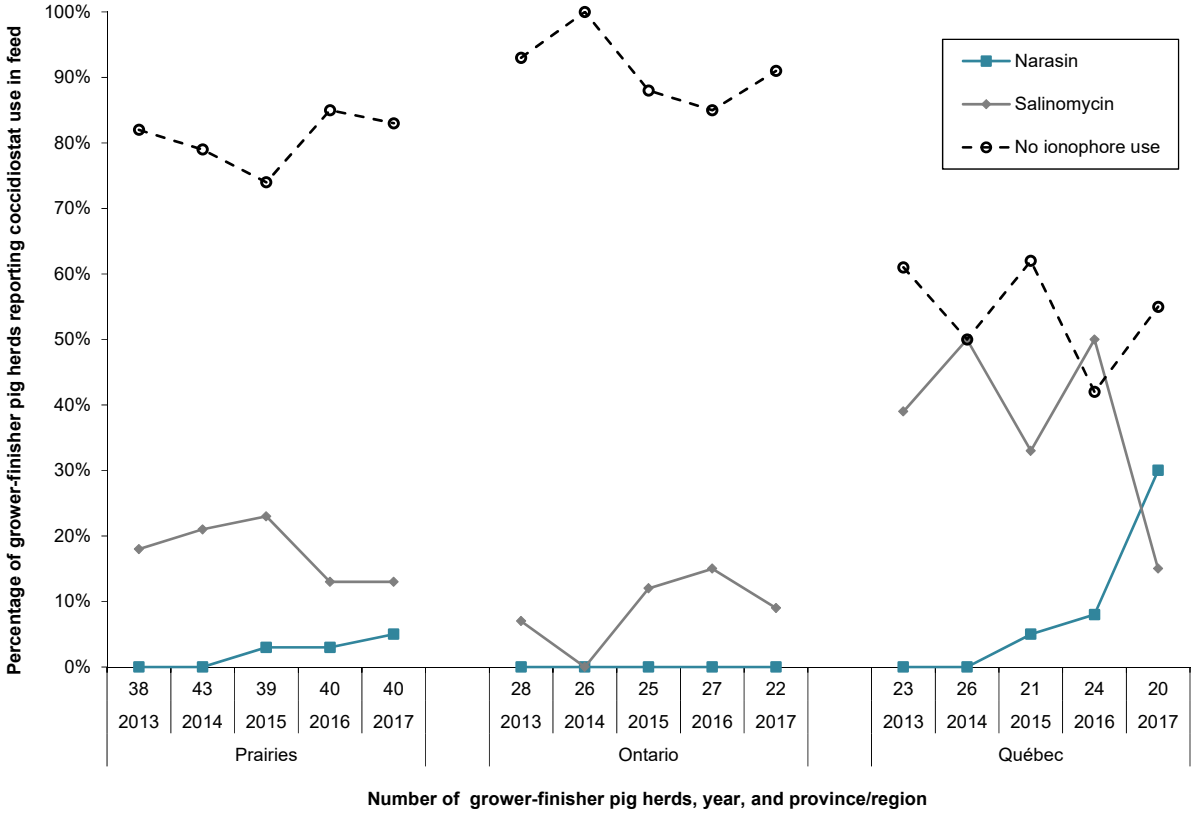


Year Number of herds	2009 95	2010 90	2011 93	2012 87	2013 89	2014 95	2015 85	2016 91	2017 82
Coccidiostat									
IV Narasin	**0%**	0%	0%	0%	0%	0%	2%	**3%**	**10%**
Salinomycin	**14%**	11%	17%	20%	20%	23%	22%	**23%**	**12%**
No ionophore use in feed	**86%**	89%	83%	80%	80%	77%	75%	**74%**	**78%**

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 coccidiostat in the current year has been compared to the proportion (%) of herds using the same coccidiostat 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 coccidiostat.

Figure 2. 46 Percentage of pig herds reporting ionophore coccidiostat use in feed, by province/region, 2012 to 2017



Province/region		Prairies					Ontario					Québec				
Year		2013	2014	2015	2016	2017	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Number of herds		38	43	39	40	40	28	26	25	27	22	23	26	21	24	20
Coccidiostat																
IV	Narasin	**0%**	0%	3%	**3%**	**5%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	5%	**8%**	**30%**
	Salinomycin	**18%**	21%	23%	**13%**	**13%**	**7%**	0%	12%	**15%**	**9%**	**39%**	50%	33%	**50%**	**15%**

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 by 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 (2017 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.

Farm Surveillance in turkeys

Summary of antimicrobials use by all routes of administration

Table 2. 16 Number of turkey flocks with reported antimicrobial use by route of administration, 2017

Antimicrobial use	Route of administration			
	Any route[a] n (%)	*In ovo*/subcutaneous n (%)	Feed n (%)	Water n (%)
Any antimicrobial use	59 (80)	52 (72)	59 (80)	10 (14)
No antimicrobial use[b]	15 (20)	20 (28)	15 (20)	64 (86)
Total flocks	**74 (100)**	**72 (100)**	**74 (100)**	**74 (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. 17 (next page).

Table 2. 17 Frequency and quantity of antimicrobial use in turkeys, 2017

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	nDDDvetCA/ PCU
Feed					g/tonne			
II	Tylosin	4 (5)	12 (3)	14 (7 ; 21)	22 (22 ; 88)	7	3	0.3
	Penicillin G procaine	1 (1)	1 (< 1)	14 (14 ; 14)	110 (110 ; 110)	0	0	0.004
	Virginiamycin	27 (36)	102 (24)	14 (6 ; 42)	22 (22 ; 22)	13	52	5
	Trimethoprim-sulfadiazine	7 (9)	8 (2)	11 (7 ; 21)	250 200; 300)	8	13	1
III	Bacitracin	28 (38)	116 (27)	14 (3 ; 28)	55 (55 ; 110)	33	38	3
	Chlortetracycline	2 (3)	2 (< 1)	9 (4 ; 14)	330 (220 ; 440)	1	0	0.04
IV	Bambermycin	12 (16)	36 (9)	18 (7 ; 53)	2 (2 ; 4)	1		
No AMU in feed		15 (20)	32 (137)					
Total feed, medicated		**59 (80)**	**285 (68)**			**62**	**107**	**9**
Water			**Treatment (n)**		**g/Liter**			
I	Enrofloxacin	1 (1)	1	5 (5 ; 5)	< 0.1	0.001	0.01	0.001
II	Amoxicillin	1 (1)	1	5 (5 ; 5)	0.14 (0.14 ; 0.14)	0.1	0.2	0.02
	Penicillin	4 (5)	4	5 (5 ; 5)	0.13 (0.13 ; 0.13)	0.0	0.9	0.07
	Penicillin-streptomycin	1 (1)	1	6 (3 ; 6)	0.18 (0.18 ; 0.55)	0.6	0.0	0.001
III	Neomycin	1 (1)	1	5 (5 ; 5)	0.11 (0.11 ; 0.11)	0.0	0.2	0.01
	Sulfaquinoxaline	2 (3)	2	5 (3 ; 6)	0.29 (0.29 ; 0.29)	0.2	0.1	0.01
	Sulfaquinoxaline-pyrimethamine	1 (1)	1	4 (4 ; 4)	0.05 (0.05 ; 0.05	0.0	0.0	0.003
No AMU in water		64 (86)						
Total water, medicated		**10 (14)**	**11**			**0.9**	**1.4**	**0.12**
Injection					**mg/egg or poult**			
II	Gentamicin	52 (72)			1	0.1	0.1	0.01
No AMU via injection		20 (28)						
Total injection		**52 (72)**				**0.1**	**0.1**	**0.01**
All routes[d]		**59 (80)**				**63**	**108**	**9**

See corresponding footnotes on next page.

Table 2. 17 Frequency and quantity of antimicrobial use in turkeys, 2017 (continued)

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

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 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 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

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

nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

[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, nDDDvetCA/1,000 turkey-days at risk and nDDDvetCA/PCU exclude coccidiostats. Flavophospholipids was includedd only in the mg/PCU.

Table 2. 18 Production, biomass and quantity of antimicrobials used, by province/region, 2016 to 2017

Province/ region	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		nDDDvetCA/PCU	
							Total	% change[b]	Total	% change[b]	Total	% change[b]
British Columbia	2016	30	9	88	96,093,296	1,973,663	49		88		8	
	2017	27	9	89	125,474,395	1,599,299	78	61	122	39	11	46
Ontario	2016	30	10	91	102,916,844	1,170,514	88		143		12	
	2017	31	10	89	79,962,067	1,353,281	59	-33	111	-22	9	-25
Québec	2016	12	12	96	20,915,816	485,394	43		73		6	
	2017	16	11	90	20,382,878	626,239	33	-24	65	-12	5	-14
National[c]	2016	72	10	90	219,925,956	3,629,571	61		104		9	
	2017	74	10	89	225,819,340	3,578,819	63	4	108	4	9	5

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 turkey per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

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

nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

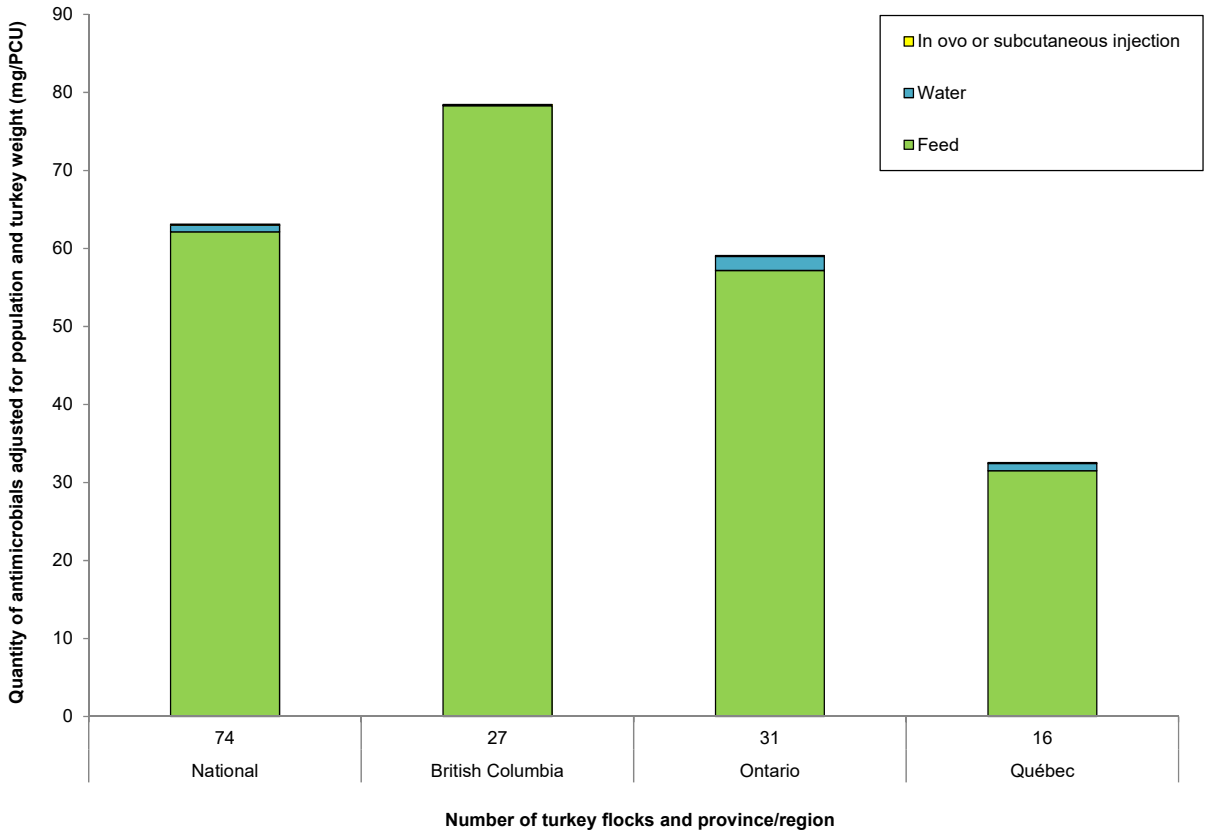
For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

[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 Overall quantity of antimicrobial use in all routes of administration, adjusted for population and turkey weight (mg/PCU), 2017



Province/region	National		British Columbia		Ontario		Québec	
Year	2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks	72	74	30	27	30	31	12	16
Route of administration								
Feed	59.8	62.1	48.1	78.3	86.6	57	43.0	31.5
Water	0.6	0.86	0.4	0.01	1	2	0	0.9
In ovo or subcutaneous injection	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	60.6	63.1	49	78.5	87.9	59.1	43.1	32.5

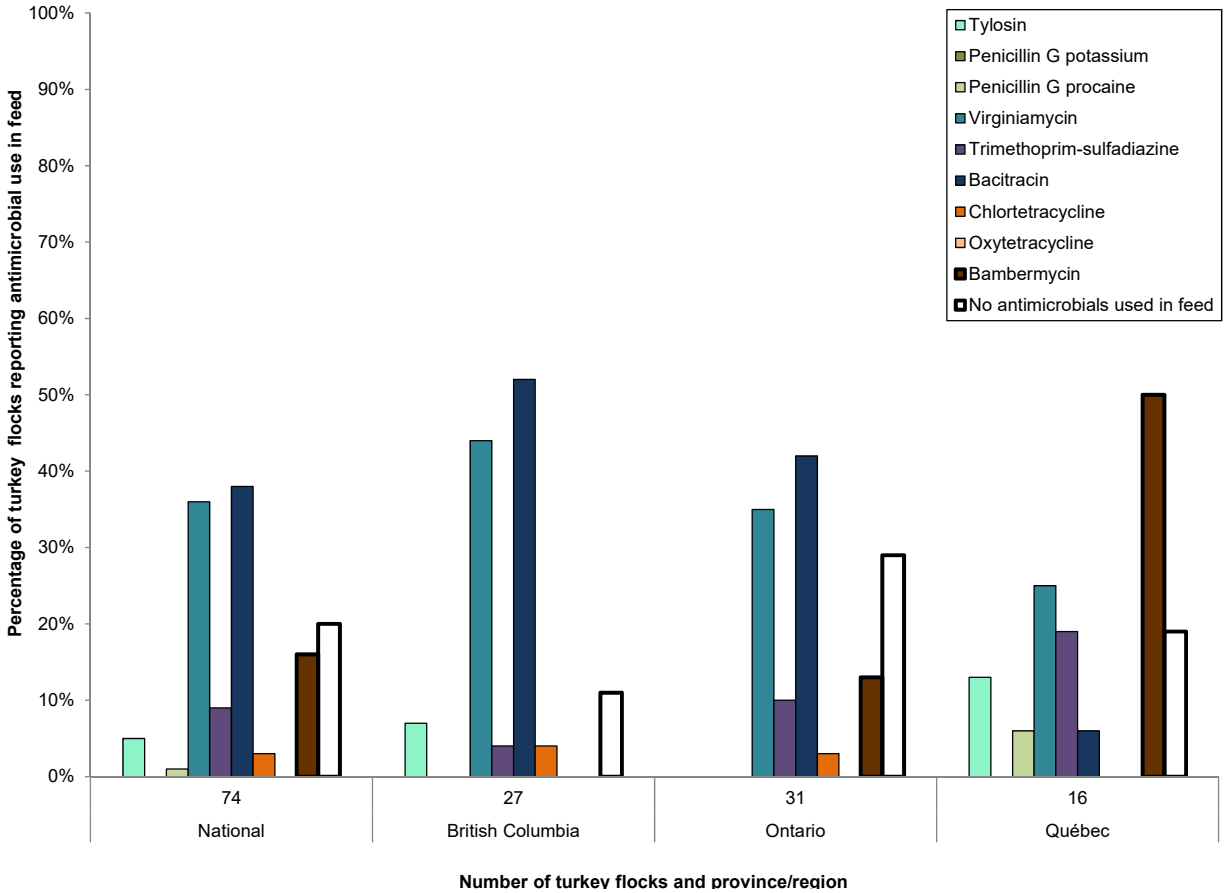
mg/PCU = milligrams/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Data in figure pertains to the current year and data in table includes all years.

Antimicrobial use in feed by frequency

Figure 2. 48 Percentage of turkey flocks reporting antimicrobial use in feed, 2017



Province/region	National		British Columbia		Ontario		Québec	
Year	2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks	72	74	30	27	30	31	12	16
Antimicrobial								
II Tylosin	7%	5%	0%	7%	7%	0%	25%	13%
II Penicillin G potassium	0%	0%	0%	0%	0%	0%	0%	0%
II Penicillin G procaine	7%	1%	3%	0%	0%	0%	33%	6%
II Virginiamycin	38%	36%	33%	44%	40%	35%	42%	25%
II Trimethoprim-sulfadiazine	6%	9%	0%	4%	10%	10%	8%	19%
III Bacitracin	36%	38%	57%	52%	30%	42%	0%	6%
III Chlortetracycline	3%	3%	0%	4%	7%	3%	0%	0%
III Oxytetracycline	3%	0%	0%	0%	0%	0%	17%	0%
IV Bambermycin	4%	16%	0%	0%	10%	13%	0%	50%
No antimicrobials used in feed	19%	20%	13%	11%	23%	29%	25%	19%

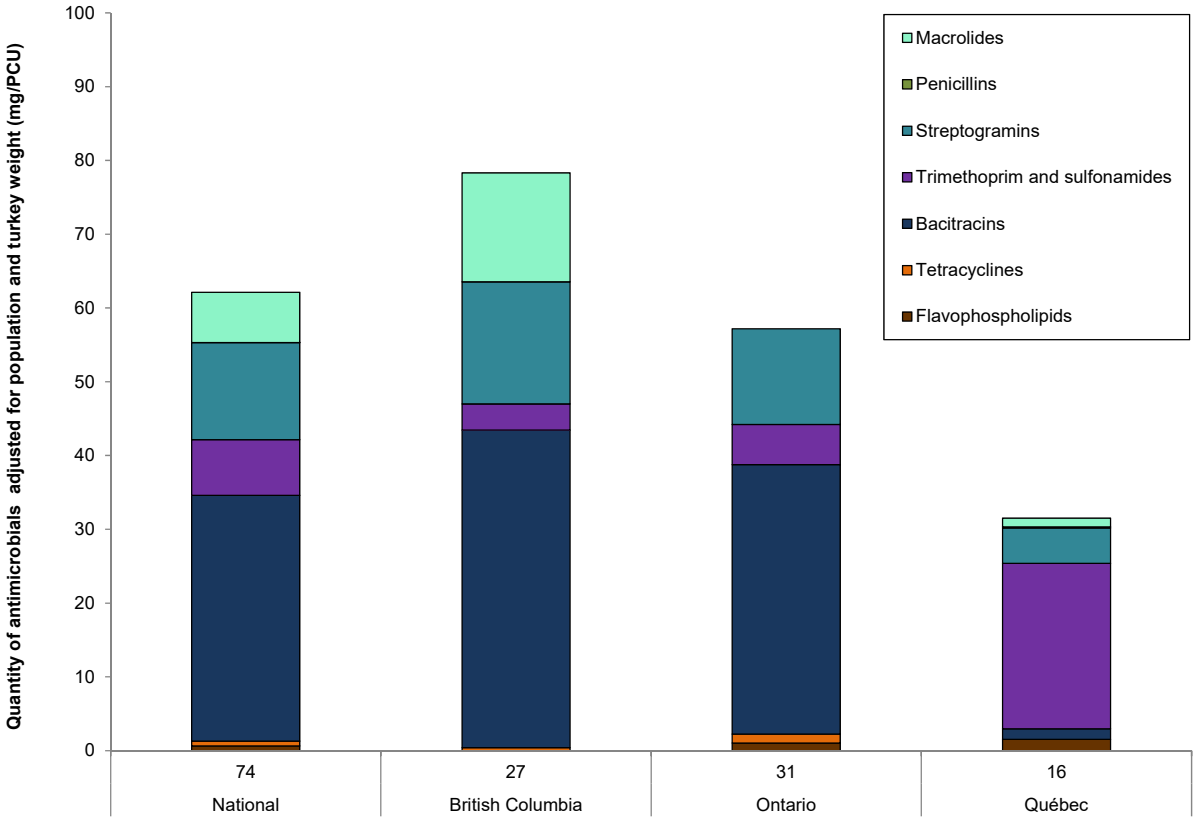
Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

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

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 excluding coccidiostats).

Antimicrobial use in feed by quantitative indicators

Figure 2. 49 Quantity of antimicrobial use in feed adjusted for population and turkey weight (mg/PCU), 2017



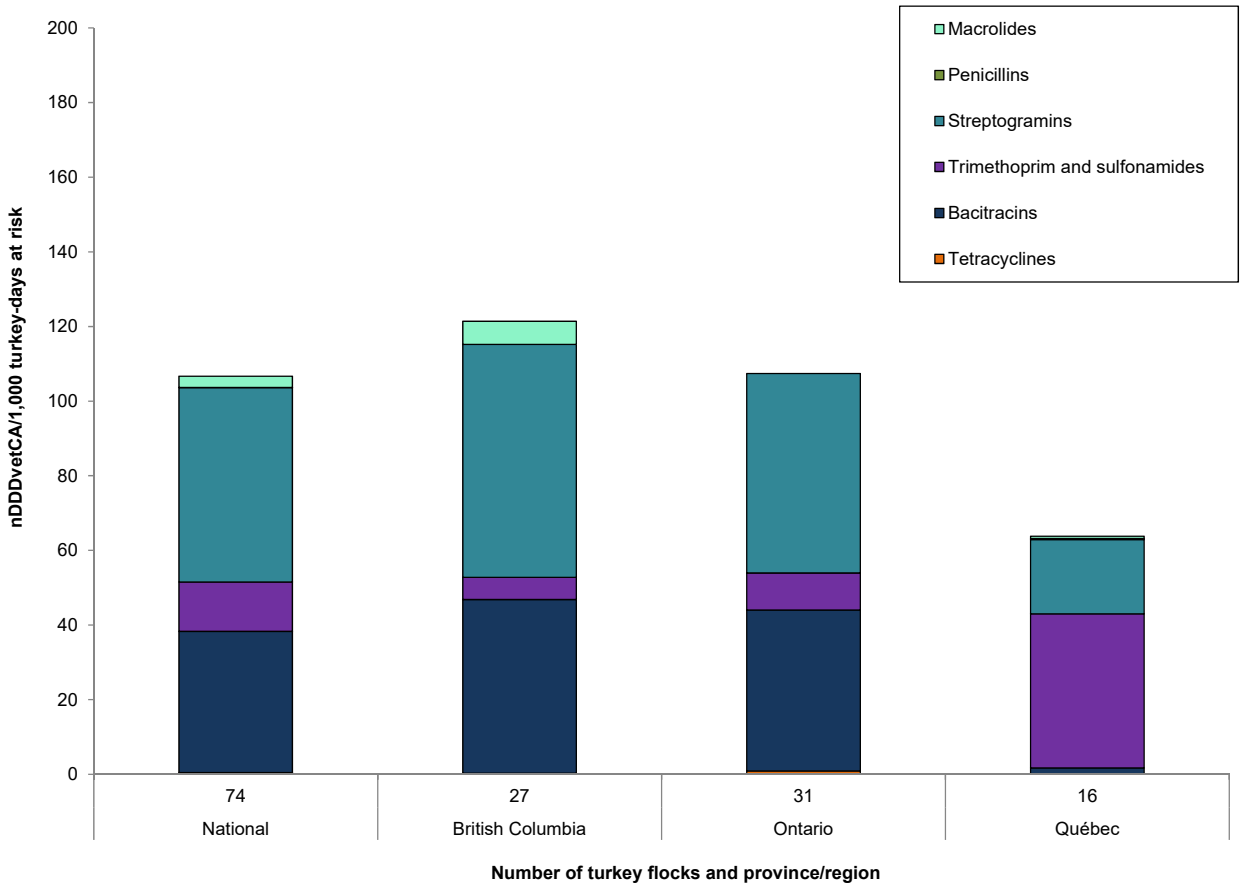
Province/region	National		British Columbia		Ontario		Québec	
Year	2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks	72	74	30	27	30	31	12	16
Antimicrobial class								
II Macrolides	2.6	6.8	0.0	14.8	2.1	0	14.1	1.2
II Penicillins	0.5	0.02	0.4	0	0	0	2.2	0.1
II Streptogramins	12.0	13.2	10.9	16.6	14.2	13.0	11.3	4.8
II Trimethoprim and sulfonamides	2.3	7.6	0	3.5	4.9	5.4	5.4	22.4
III Bacitracins	37.3	33.3	36.8	43.0	53.7	36.5	0	1.4
III Tetracyclines	5.0	0.6	0	0.4	11.2	1.2	10.1	0
IV Flavophospholipids	0.1	0.7	0	0	0.4	1.0	0	1.5
Total	59.8	62.1	48.1	78.3	86.6	57.2	43.0	31.5

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 description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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 antimicrobials administered in feed, 2017



Province/region		National		British Columbia		Ontario		Québec	
Year		2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks		72	74	30	27	30	31	12	16
Antimicrobial class									
II	Macrolides	1.1	3.0	0.0	6.2	0.9	0	6.3	0.6
II	Penicillins	1.1	0.05	0.9	0	0	0	4.7	0.3
II	Streptogramins	47.9	52.1	43.5	62.4	56.4	53.4	45.3	19.9
II	Trimethoprim and sulfonamides	5.4	13.3	0	5.9	12.7	9.9	9.6	41.3
III	Bacitracins	42.6	37.8	42.0	46.6	61.2	43.1	0	1.7
III	Tetracyclines	3.4	0.4	0	0.3	7.7	0.9	7.0	0
Total		101.6	106.7	86	121	138.9	107.4	73	63.8

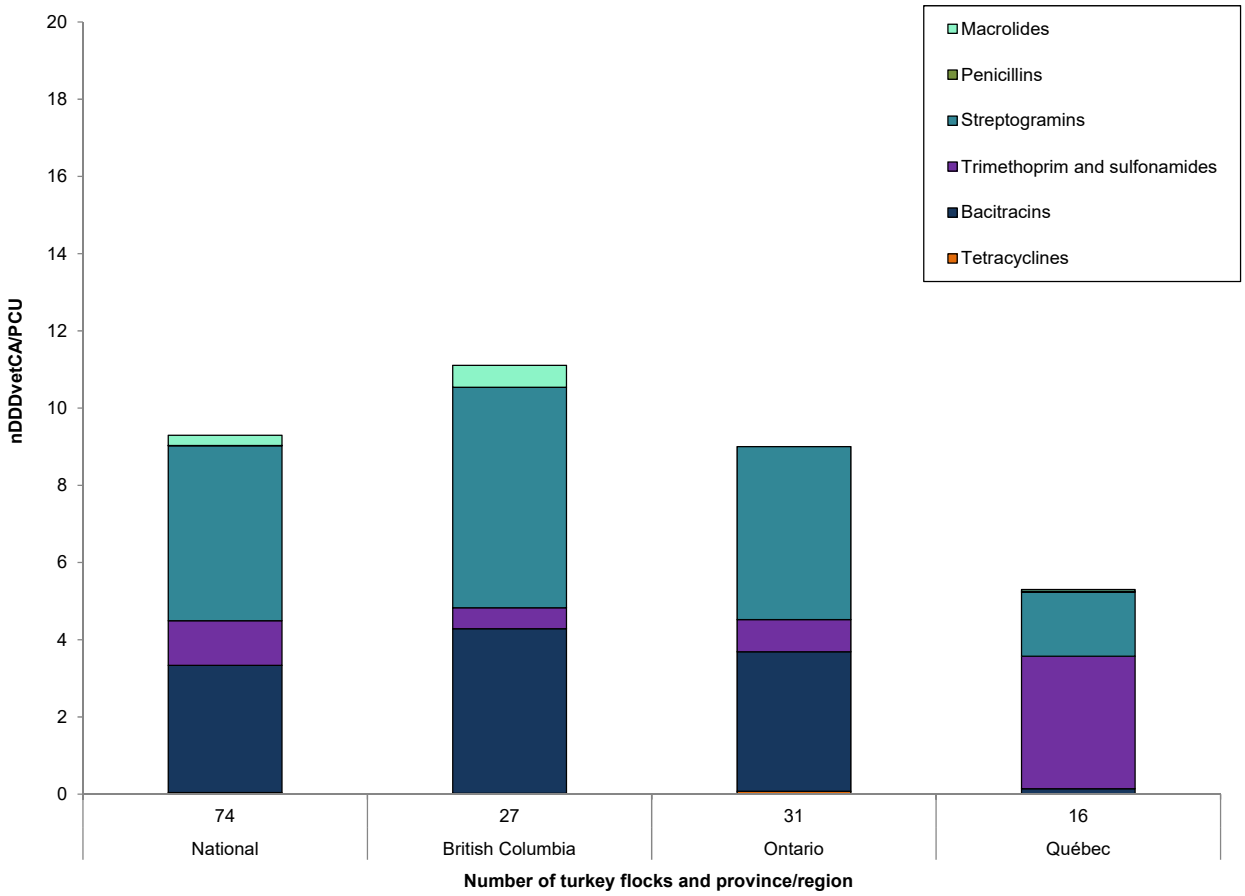
Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

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 2016 CIPARS Annual Report, 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 description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Figure 2. 51 Number of Canadian Defined Daily Doses for animals per population correction unit (nDDDvetCA/PCU) for antimicrobials adminimistered in feed, 2017



Province/region		National		British Columbia		Ontario		Québec	
Year		2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks		72	74	30	27	30	31	12	16
Antimicrobial class									
II	Macrolides	0.1	0.3	0.0	0.6	0.1	0	0.5	0.0
II	Penicillins	0.1	0.00	0.1	0	0	0	0.4	0.0
II	Streptogramins	4.2	4.5	3.8	5.7	4.9	4.5	3.9	1.7
II	Trimethoprim and sulfonamides	0.5	1.2	0	0.5	1.1	0.8	0.8	3.4
III	Bacitracins	3.7	3.3	3.6	4.3	5.3	3.6	0	0.1
III	Tetracyclines	0.3	0.0	0	0.02	0.7	0.1	0.6	0
Total		8.8	9.3	7	11	12.1	9.0	6	5.3

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

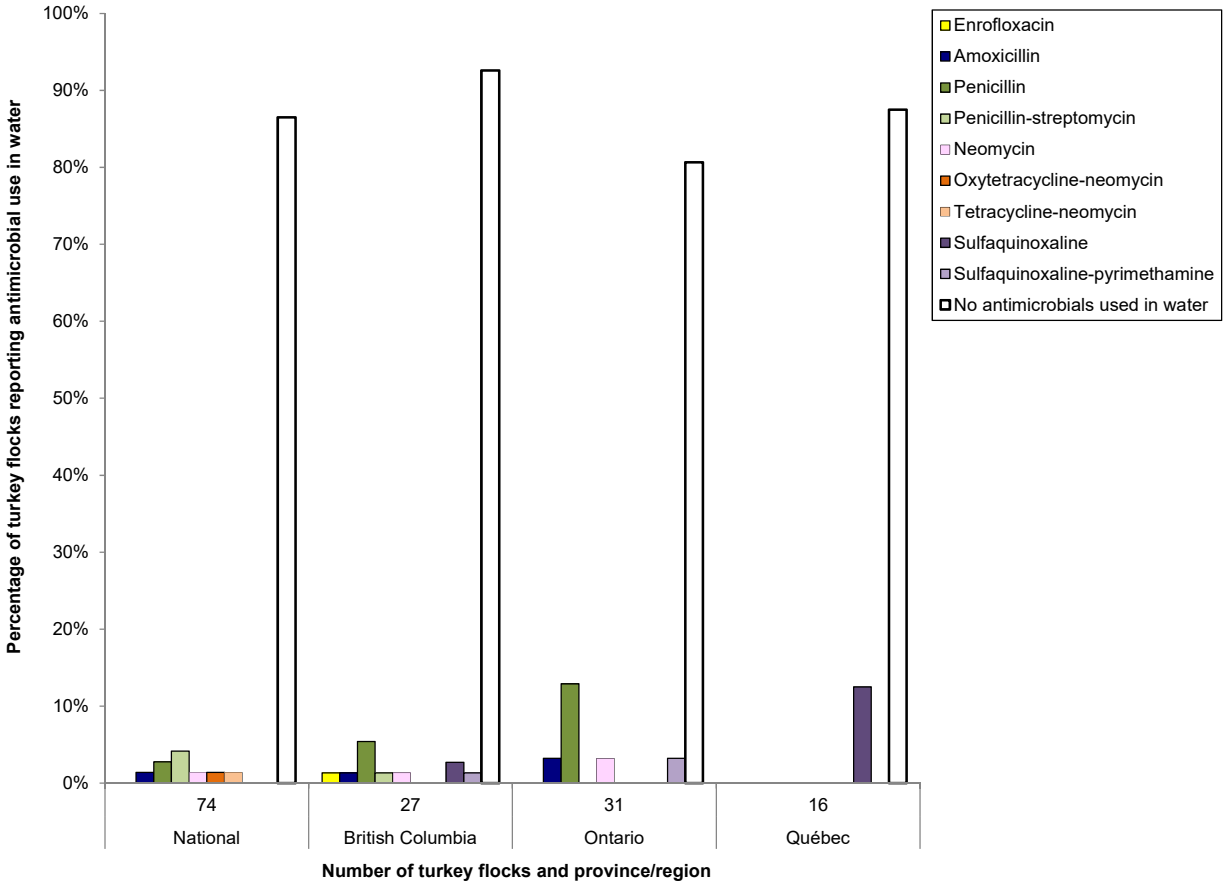
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram turkey weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Antimicrobial use in water by frequency

Figure 2. 52 Percentage of turkey flocks reporting antimicrobial use in water, 2017



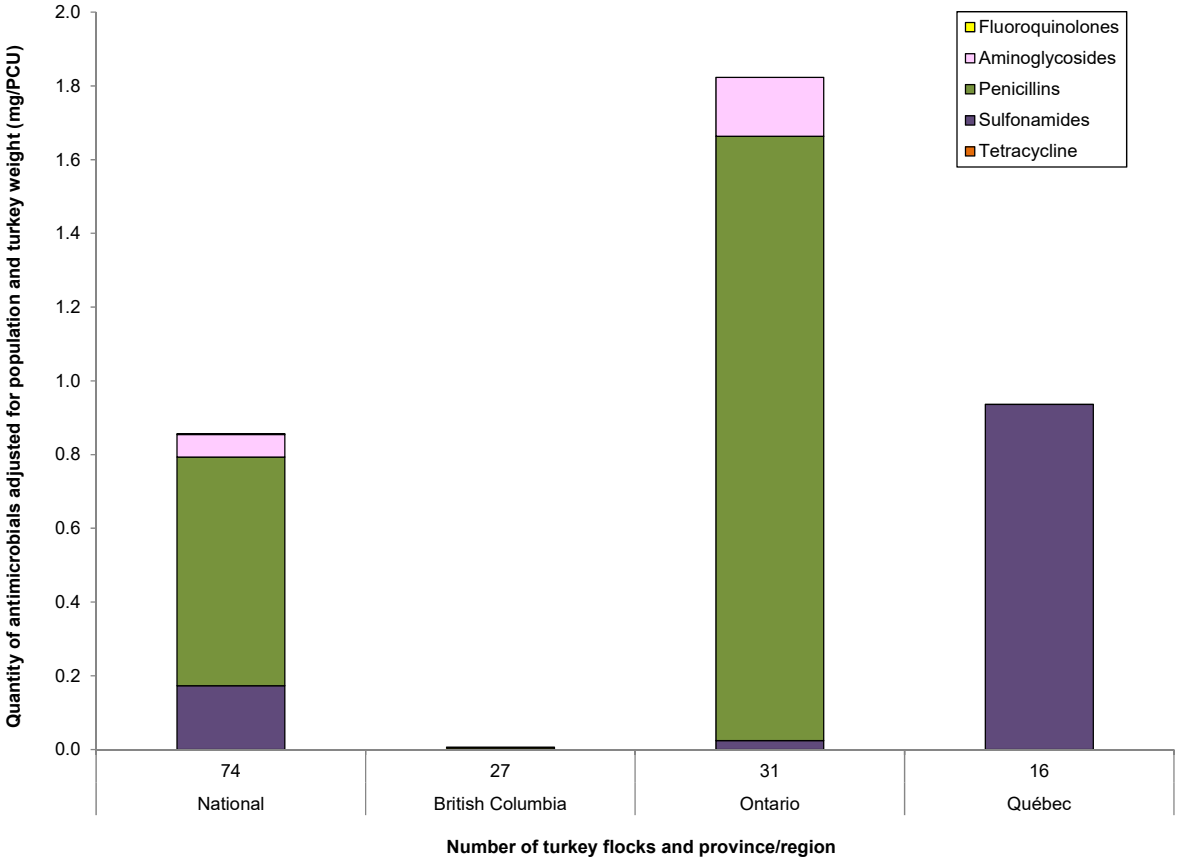
Province/Region	National		British Columbia		Ontario		Québec	
Year	2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks	72	74	30	27	30	31	12	16
Antimicrobial								
I Enrofloxacin	0%	1%	0%	4%	0%	0%	0%	0%
Amoxicillin	1%	1%	0%	0%	3%	3%	0%	0%
II Penicillin	3%	5%	0%	0%	7%	13%	0%	0%
Penicillin-streptomycin	4%	1%	10%	4%	0%	0%	0%	0%
Neomycin	1%	1%	0%	0%	3%	3%	0%	0%
Oxytetracycline-neomycin	1%	0%	3%	0%	0%	0%	0%	0%
III Tetracycline-neomycin	1%	0%	0%	0%	3%	0%	0%	0%
Sulfaquinoxaline	0%	3%	0%	0%	0%	0%	0%	13%
Sulfaquinoxaline-pyrimethamine	0%	1%	0%	0%	0%	3%	0%	0%
No antimicrobials used in water	86%	93%	87%	93%	87%	81%	100%	88%

Roman numerals II 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.

Antimicrobial use in water by quantitative indicators

Figure 2. 53 Quantity of antimicrobial use in water adjusted for population and turkey weight (mg/PCU), 2017



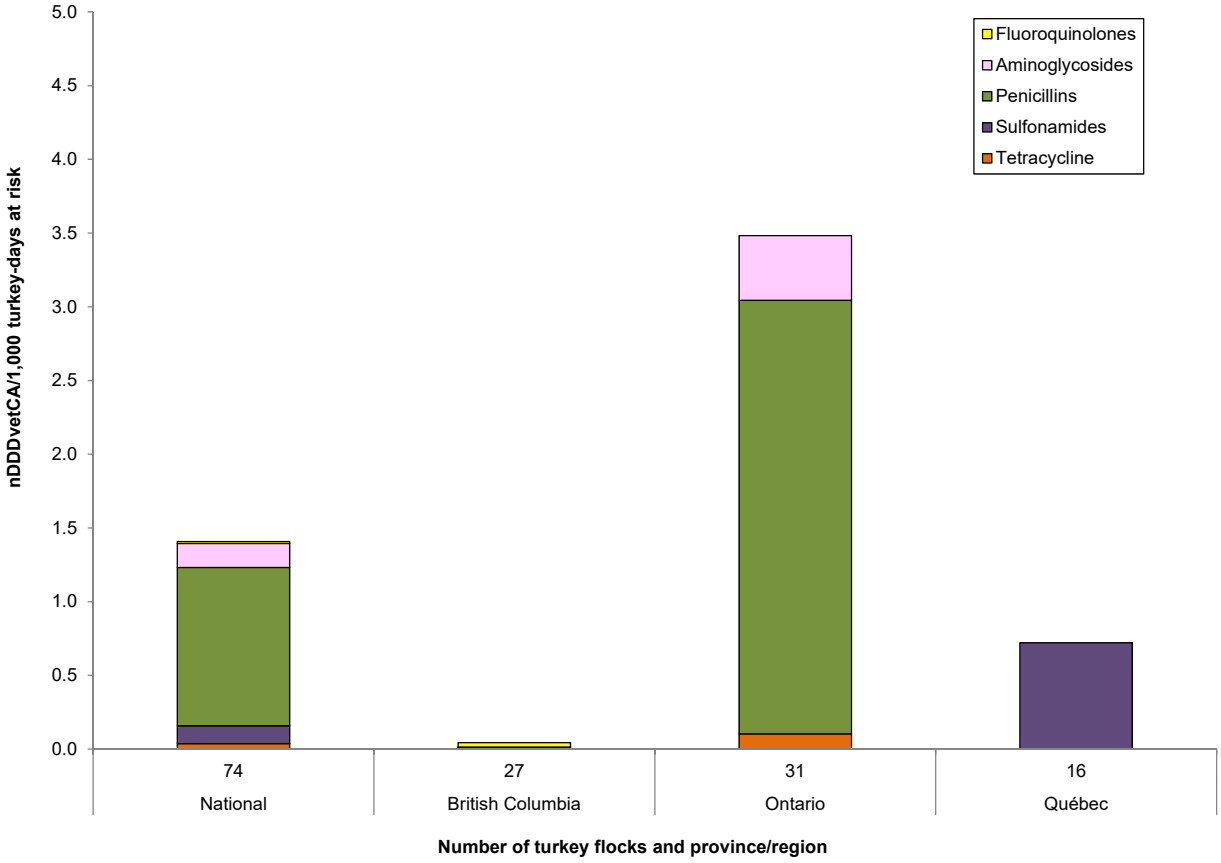
Province/region	National		British Columbia		Ontario		Québec	
Year	2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks	72	74	30	27	30	31	12	16
Antimicrobial class								
I Fluoroquinolones	0	0.001	0	0.003	0	0	0	0
II Aminoglycosides	0.24	0.06	0.23	0.003	0.34	0.16	0	0
II Penicillins	0.29	0.62	0.02	0.001	0.85	1.64	0	0
III Sulfonamides	0	0.17	0	0	0	0.02	0	0.94
III Tetracycline	0.10	0	0.15	0	0.04	0	0	0
Total	0.62	0.86	0.41	0.01	1.23	1.82	0	0.94

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 description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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 water, 2017



Province/region	National		British Columbia		Ontario		Québec	
Year	2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks	72	74	30	27	30	31	12	16
Antimicrobial class								
I Fluoroquinolones	0	0.014	0	0.030	0	0	0	0
II Aminoglycosides	0.55	0.16	0.47	0.007	0.91	0.44	0	0
II Penicillins	1.02	1.07	0.31	0.007	2.63	2.94	0	0
III Sulfonamides	0	0.16	0	0	0	0.10	0	0.72
III Tetracycline	0.19	0	0.28	0	0.11	0	0	0
Total	1.76	1.41	1.06	0.04	3.65	3.48	0	0.72

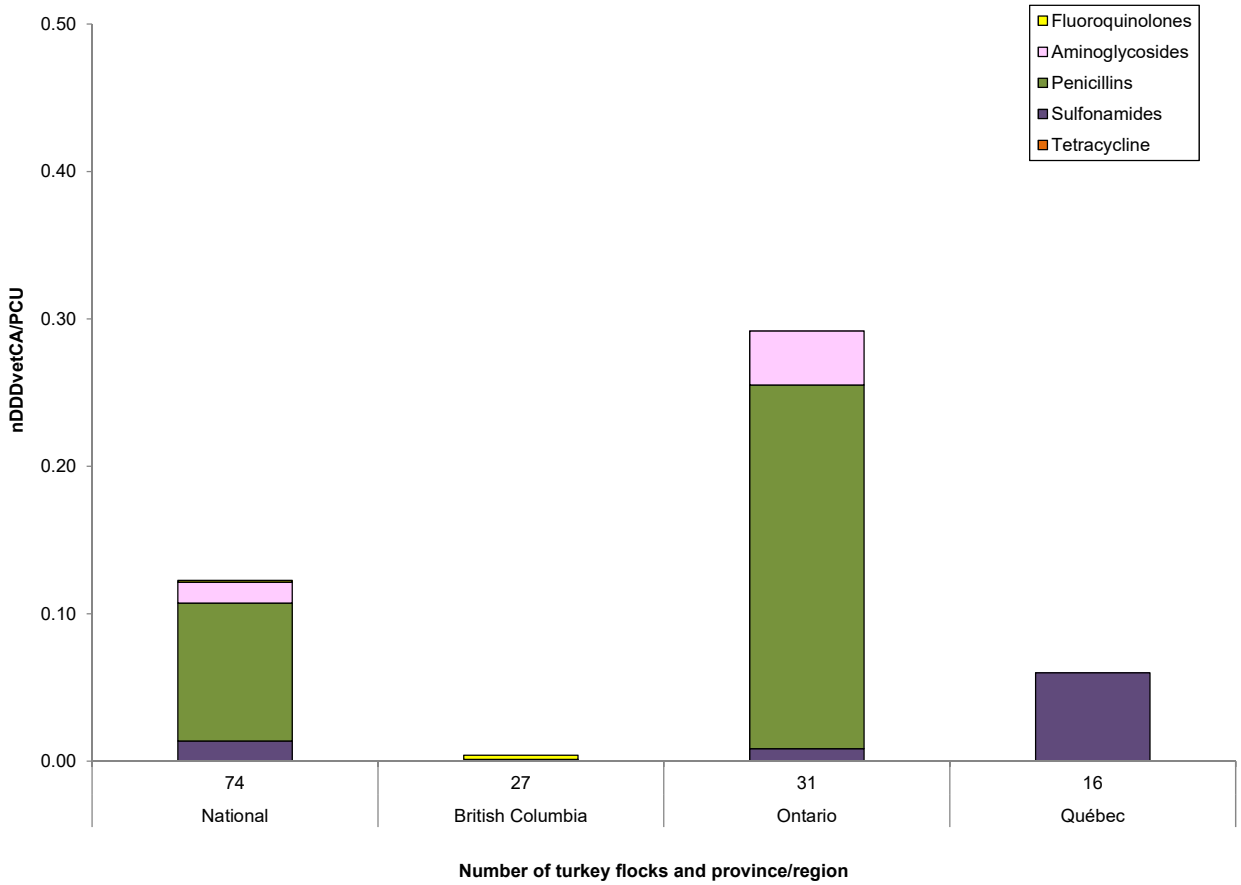
Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

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 2016 CIPARS Annual Report, 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 description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Figure 2. 55 Number of Canadian Defined Daily Doses for animals per population correction unit (nDDDvetCA/PCU) for antimicrobials administered in water, 2017



Province/region	National		British Columbia		Ontario		Québec	
Year	2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks	72	74	30	27	30	31	12	16
Antimicrobial class								
I Fluoroquinolones	0	0.001	0	0.003	0	0	0	0
II Aminoglycosides	0.05	0.01	0.04	0.001	0.08	0.04	0	0
Penicillins	0.09	0.09	0.03	0.001	0.23	0.25	0	0
III Sulfonamides	0	0.01	0	0	0	0.009	0	0.06
Tetracycline	0.02	0	0.02	0	0.01	0	0	0
Total	0.15	0.12	0.09	0.004	0.32	0.29	0	0.06

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

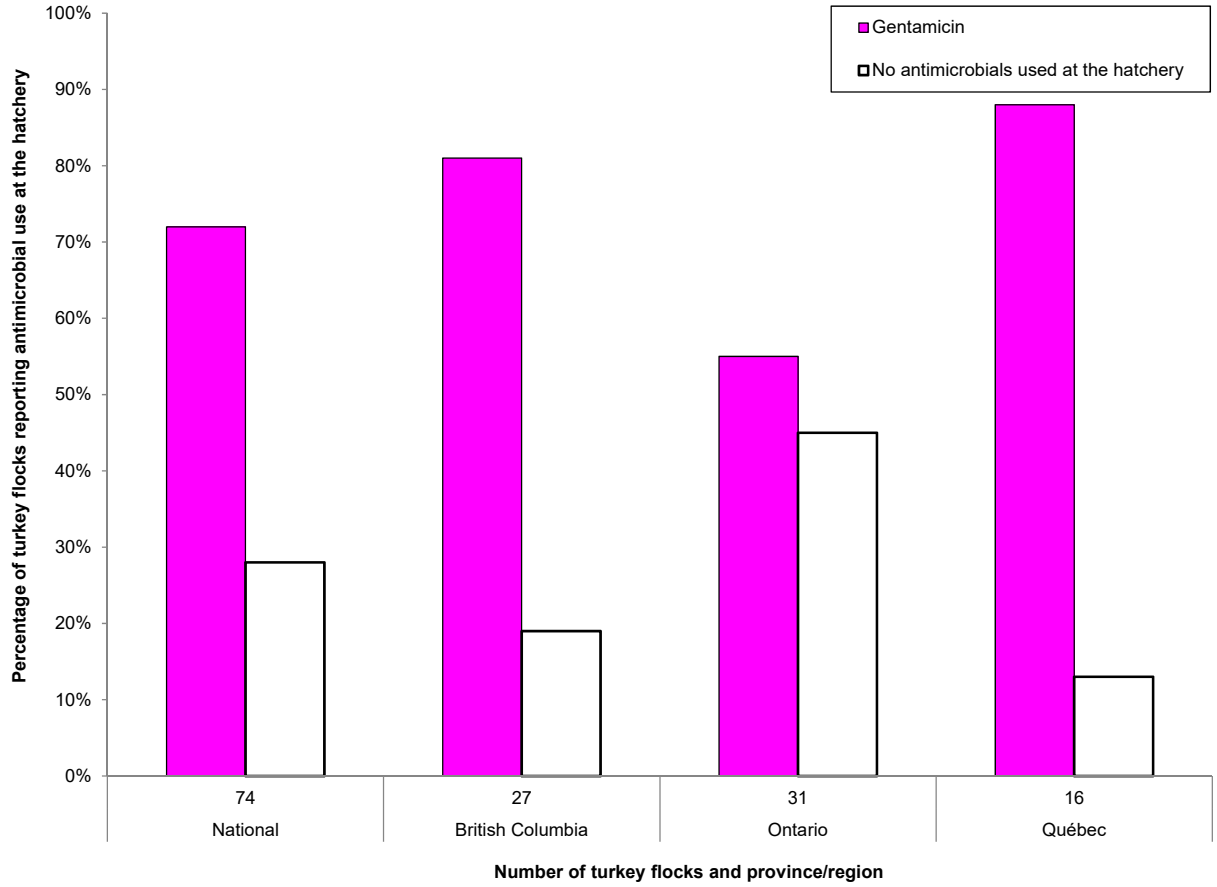
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram turkey weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Antimicrobials use *in ovo* or subcutaneous injection by frequency

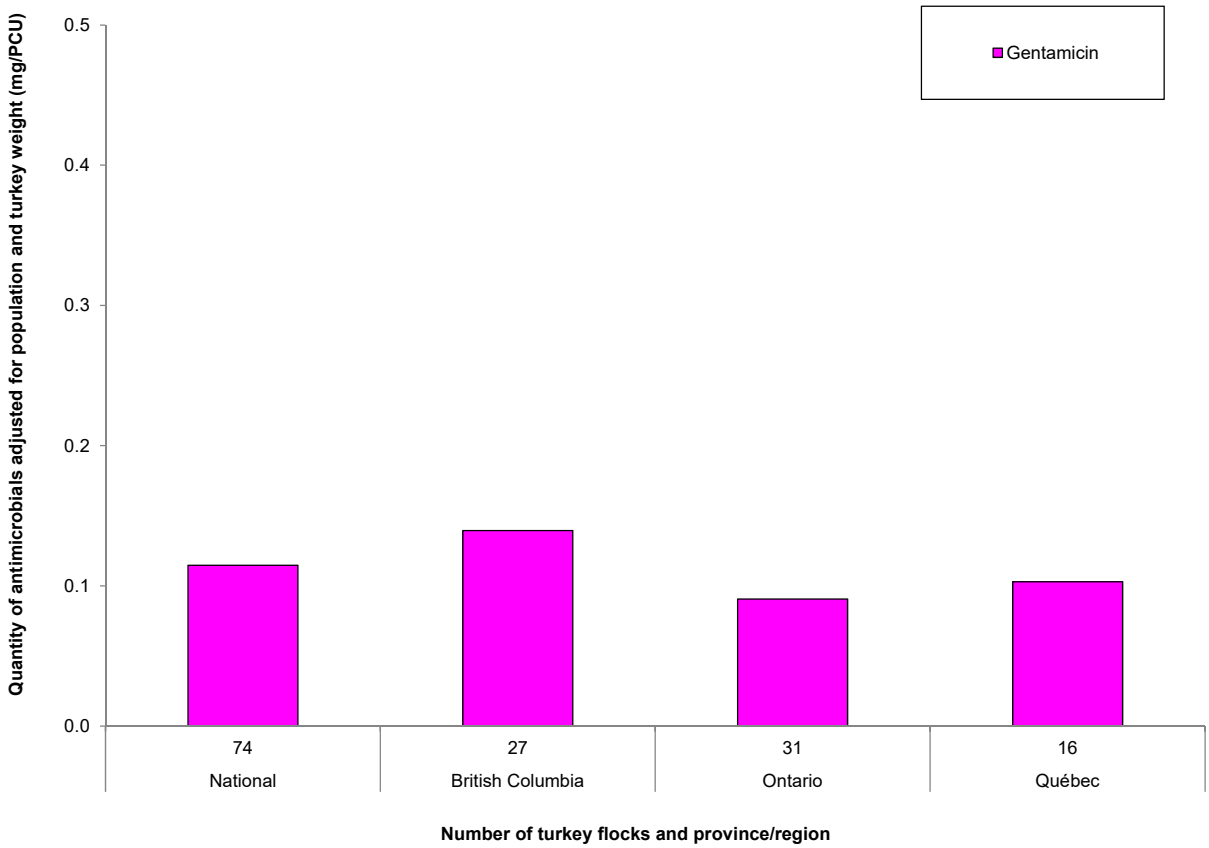
Figure 2. 56 Percentage of turkey flocks reporting antimicrobial use *in ovo* or subcutaneous injection, 2017



Province/region	National		British Columbia		Ontario		Québec	
Year	2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks	72	74	30	27	30	31	12	16
Antimicrobial								
II Gentamicin	81%	72%	83%	81%	77%	55%	83%	88%
No antimicrobials used at the hatchery	19%	28%	17%	19%	23%	45%	17%	13%

Roman numeral II indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Data represent flocks medicated at the hatchery at day 18 of incubation or upon hatch.

Figure 2. 57 Quantity of antimicrobial use *in ovo* or subcutaneous injection adjusted for population and turkey weight (mg/PCU), 2017



Province/region	National		British Columbia		Ontario		Québec	
Year	2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks	72	74	30	27	30	31	12	16
Antimicrobial								
II Gentamicin	0.13	0.11	0.13	0.14	0.13	0.09	0.11	0.10
Total	0.13	0.11	0.13	0.14	0.13	0.09	0.11	0.10

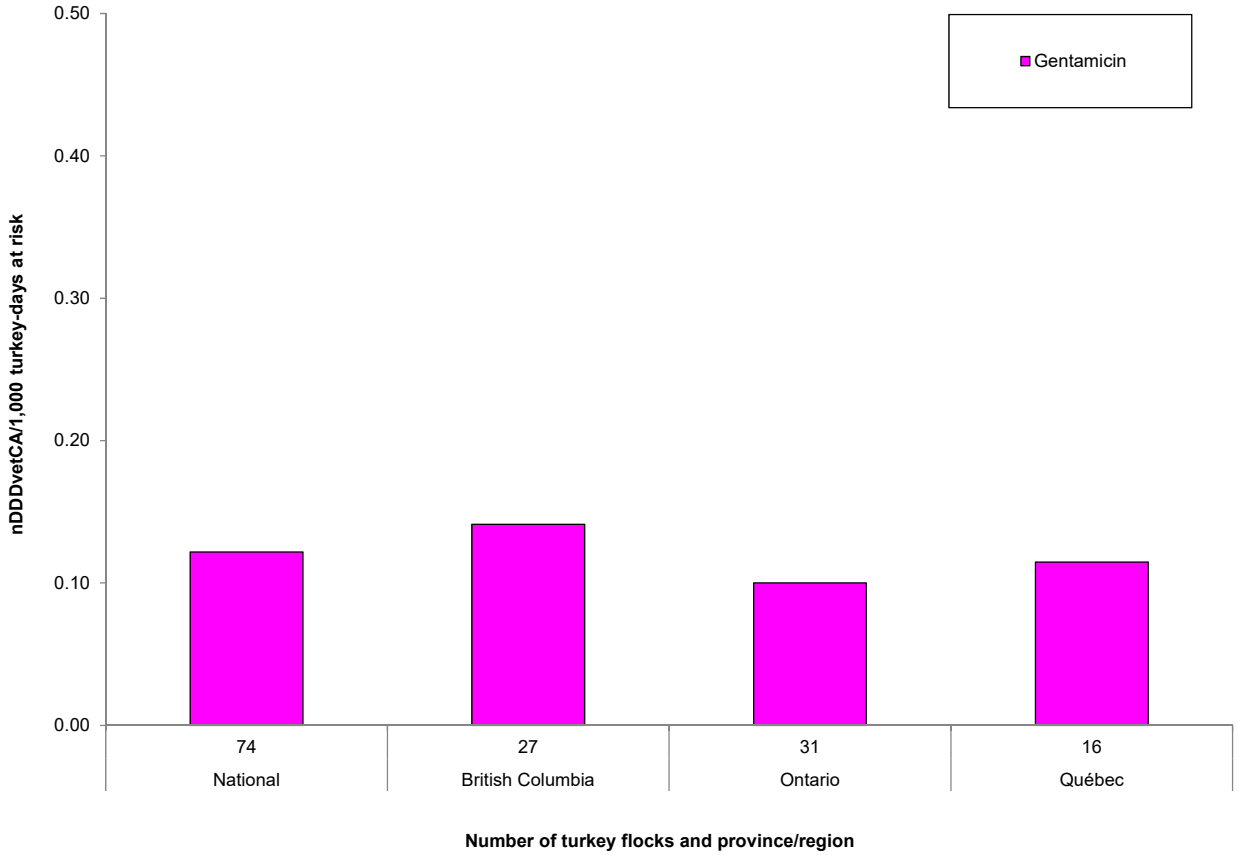
Roman numeral II indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate.

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 description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

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 ovo* or subcutaneous injection, 2017



Province/region	National		British Columbia		Ontario		Québec	
Year	2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks	72	74	30	27	30	31	12	16
Antimicrobial								
II Gentamicin	0.14	0.12	0.14	0.14	0.14	0.10	0.12	0.11
Total	0.14	0.12	0.14	0.14	0.14	0.10	0.12	0.11

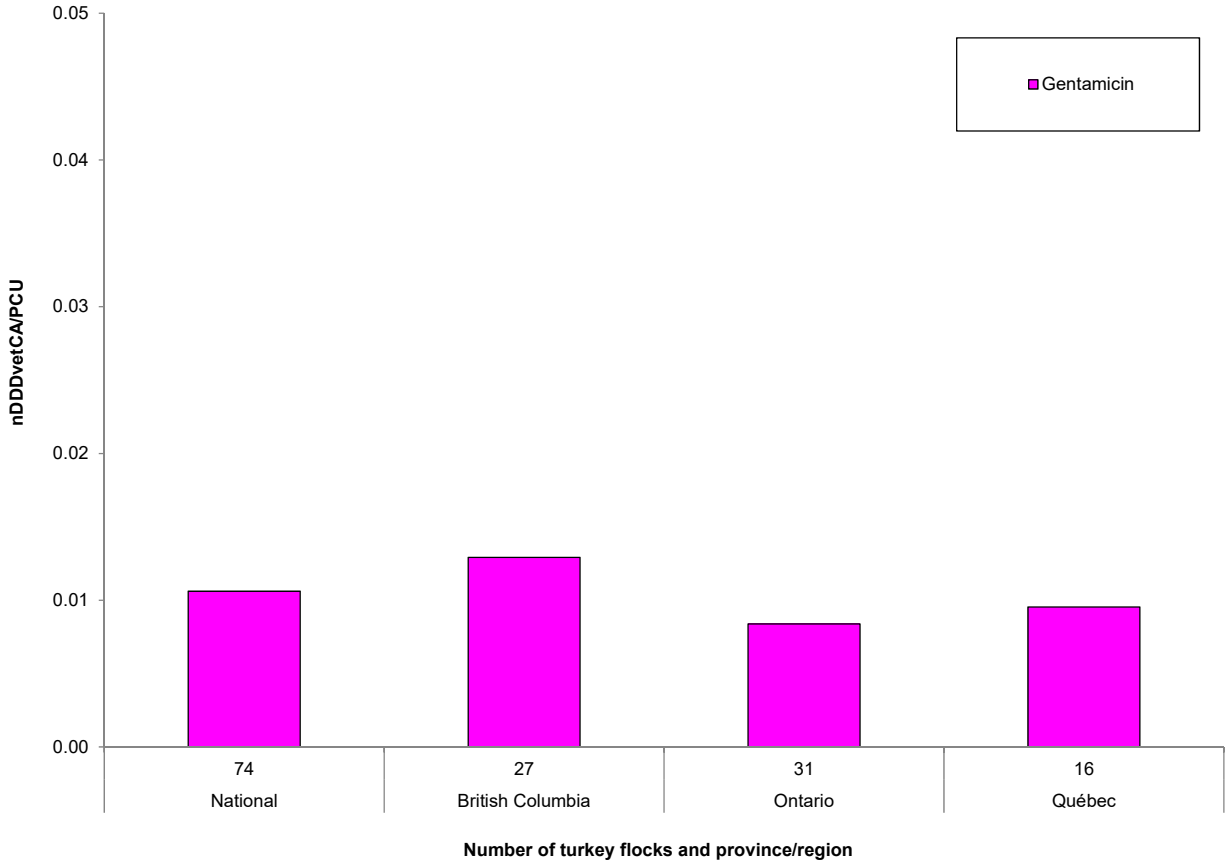
Roman numeral II indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate.

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 2016 CIPARS Annual Report, 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 description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Figure 2. 59 Number of Canadian Defined Daily Doses for animals per population correction unit (nDDDvetCA/PCU) for antimicrobials administered *in ovo* or subcutaneous injection, 2017



Province/region	National		British Columbia		Ontario		Québec	
Year	2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks	72	74	30	27	30	31	12	16
Antimicrobial								
II Gentamicin	0.012	0.011	0.012	0.013	0.012	0.008	0.010	0.010
Total	0.012	0.011	0.012	0.013	0.012	0.008	0.010	0.010

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

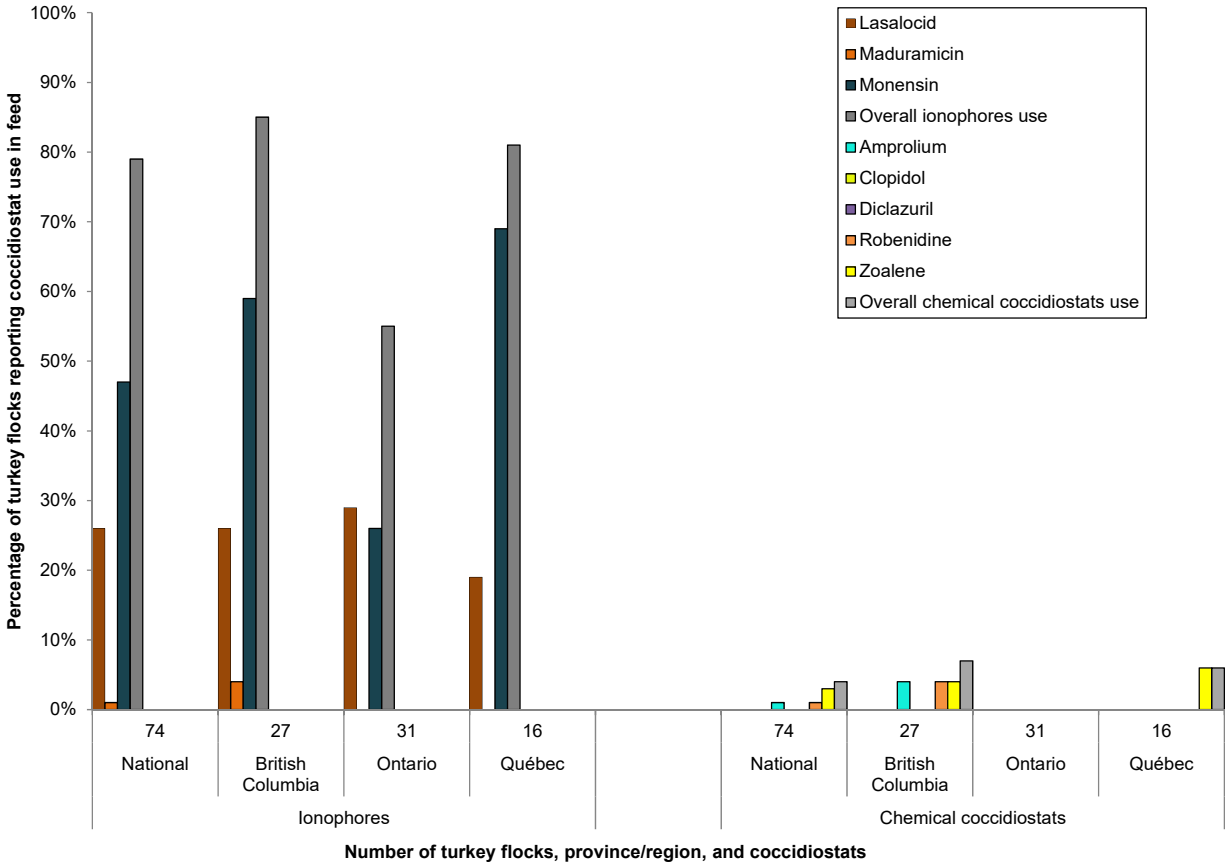
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram turkey weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 2016 CIPARS Annual Report, Table A. 1 for the list of standards.

nDDDvetCA/PCU = number of DDDvetCA/population correction unit.

For detailed indicator description, please refer to Chapter 5: Design and methods of the CIPARS 2016 Annual Report.

Coccidiostat and antiprotozoal use in feed by frequency

Figure 2. 60 Percentage of turkey flocks reporting coccidiostat and other antiprotozoals use in feed, 2017



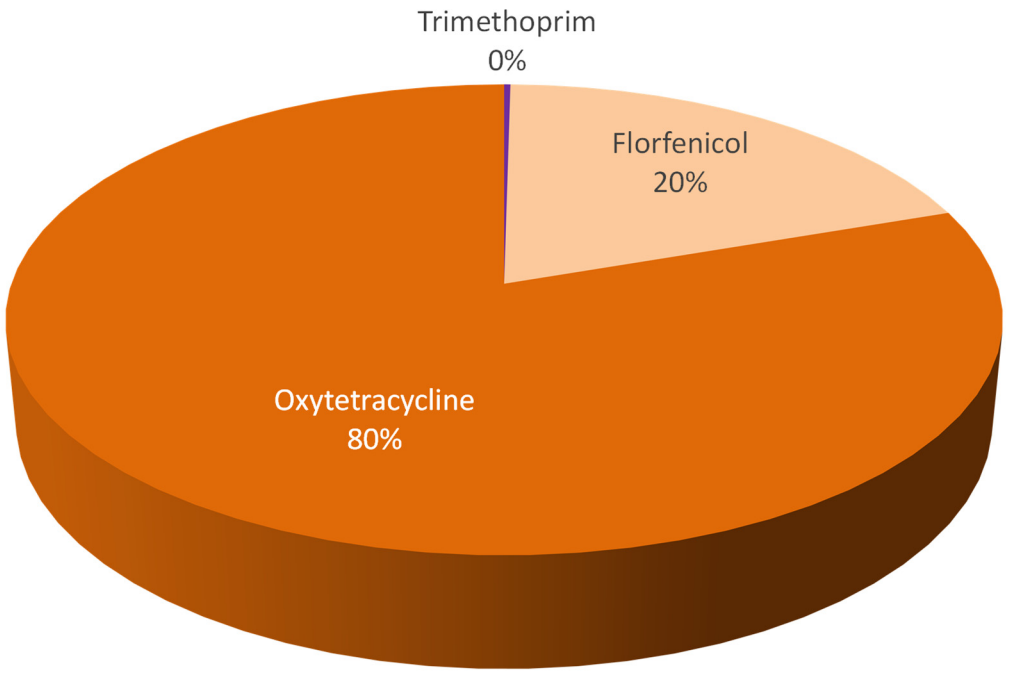
Province/region		National		British Columbia		Ontario		Québec	
Year		2016	2017	2016	2017	2016	2017	2016	2017
Number of flocks		72	74	30	27	30	31	12	16
Coccidiostat									
IV	Lasalocid	47%	26%	43%	26%	47%	29%	58%	19%
IV	Maduramicin	13%	1%	23%	4%	7%	0%	0%	0%
IV	Monensin	28%	47%	37%	59%	17%	26%	33%	69%
IV	**Overall ionophores use**	83%	72%	93%	85%	70%	55%	92%	81%
N/A	Clopidol	3%	0%	7%	0%	0%	0%	0%	0%
N/A	Diclazuril	1%	0%	3%	0%	0%	0%	0%	0%
N/A	Robenidine	1%	1%	3%	4%	0%	0%	0%	0%
N/A	Zoalene	1%	3%	0%	4%	3%	0%	0%	6%
N/A	**Overall chemical coccidiostats use**	6%	4%	10%	7%	3%	0%	0%	6%

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).

Marine and freshwater finfish

Summary of antimicrobials use by all routes of administration

Figure 2. 61 Relative quantities (kg) of antimicrobials used in land-based and freshwater net pen facilities and marine finfish, 2017



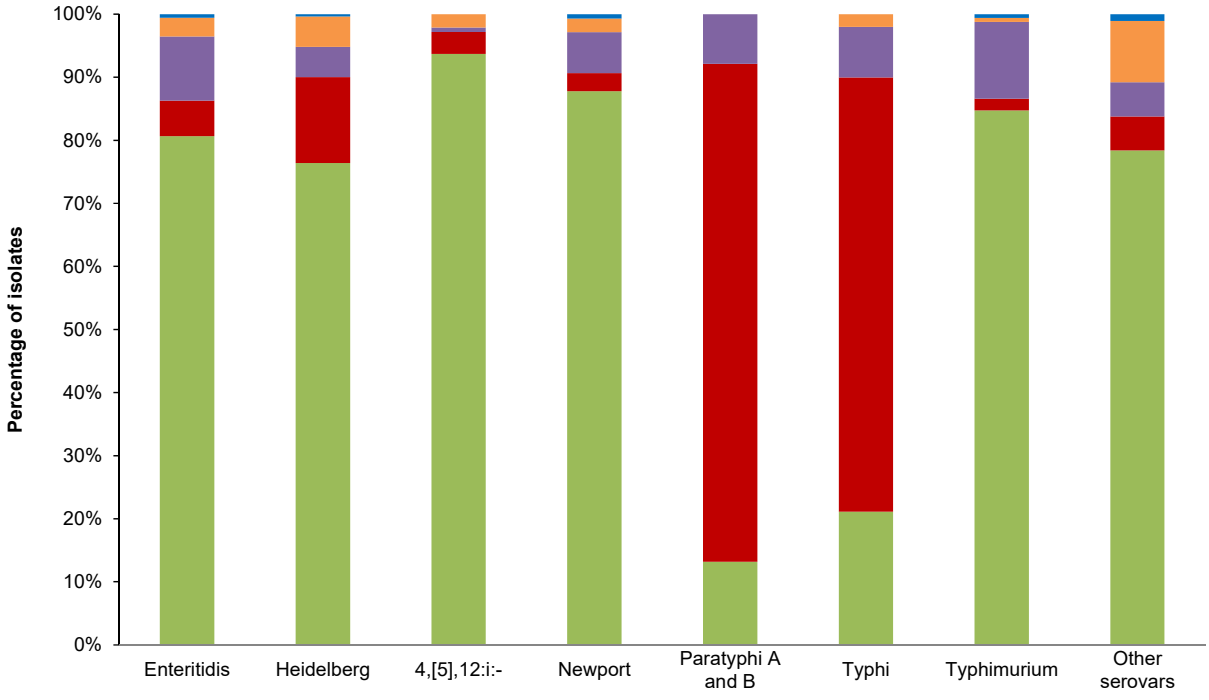
Data sources: Fisheries and Oceans Canada (https://open.canada.ca/data/en/dataset/288b6dc4-16dc-43cc-80a4-2a45b1f93383 Marine Finfish Data 2017 and Land-based and Freshwater Data 2017). Accessed on June 15, 2019.

Chapter 3 Antimicrobial resistance

Human Surveillance

Serovar distribution

Figure 3. 1 Proportion of human *Salmonella* serovars from all sample sources, 2017



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, 2017

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 (43)	72	12	5					2		1						2	1	15	3
Typhi	43 (20.8)	1	33	7	2			9	2					2	2		2	7	42	
Newport	20 (9.7)	18	1			1		1	1					1	1	1	1		1	1
4,[5],12:i:-	18 (8.7)	3	1		11	3	2	14	13			1		14	4		5	2	5	15
Other serovars	15 (7.2)	9	1	3	1	1	1	3	3	1	1	1		2			1	4	5	3
Typhimurium	9 (4.3)	3	3		3			3	3					3			3		3	3
Paratyphi A and B	7 (3.4)		6	1				1									1	2	7	
Heidelberg	6 (2.9)	2	3	1			1	4						1						
Total	**207 (100)**	**108**	**60**	**17**	**17**	**5**	**4**	**35**	**24**	**1**	**2**	**2**		**23**	**7**	**1**	**15**	**16**	**78**	**25**
Alberta																				
Enteritidis	125 (44)	105	17	1	2			2	1					2			1	1	17	5
Typhimurium	50 (17.6)	26	3	8	12	1	1	19	14	2	1	1		21	1		12		2	17
Typhi	27 (9.5)	4	16		7			8	6					7	7		5	3	22	1
Heidelberg	23 (8.1)	12	8	1	2		1	7	6	1	1			2	2		1			2
Other serovars	22 (7.7)	15			5	2	5	7	6	3	5	4		7	1		5	1	4	7
4,[5],12:i:-	16 (5.6)	2	5	3	4	2	1	8	8					6	2		2		3	12
Newport	15 (5.3)	11	1		2	1		2	2	1	1	1		3	2	2	3		1	3
Paratyphi A and B	6 (2.1)	1	5															2	5	
Total	**284 (100)**	**176**	**55**	**13**	**34**	**6**	**8**	**53**	**43**	**7**	**8**	**6**		**48**	**15**	**2**	**29**	**7**	**54**	**47**
Saskatchewan																				
Enteritidis	82 (61.7)	66	14		2			2	2					2		1		1	13	2
Typhimurium	21 (15.8)	14	1	1	5			7	6	1				5	1		4			5
Heidelberg	7 (5.3)	2	3	2			1	3	3	3	3	3		1						
Other serovars	7 (5.3)	3	2		1	1	2	2	4	2	3	2		2	1		1	1	2	2
Newport	5 (3.8)	5																		
Paratyphi A and B	5 (3.8)		4	1				1										2	5	
4,[5],12:i:-	4 (3)	2		1		1		2	1					1			1		1	2
Typhi	2 (1.5)		2																2	
Total	**133 (100)**	**92**	**26**	**5**	**8**	**2**	**3**	**17**	**16**	**6**	**6**	**5**		**11**	**2**	**1**	**6**	**4**	**23**	**11**
Manitoba																				
Enteritidis	97 (52.2)	69	24	4					1					2	2				27	4
Typhimurium	35 (18.8)	24	4		4	3	1	9	7	1	1	1		7	1		7	1	3	9
Other serovars	12 (6.5)	9	1	1		1		2	1		1			2	2	1	1		1	1
Typhi	11 (5.9)	2	9																9	
4,[5],12:i:-	10 (5.4)	1	1	1	6	1		8	6		2			8			2	1	2	8
Heidelberg	10 (5.4)	3	6	1			1	5	1	1	1	1		1					1	
Newport	8 (4.3)	6	1		1			2	1	1	1	1		1			1			1
Paratyphi A and B	3 (1.6)	2	1															1	1	
Total	**186 (100)**	**116**	**47**	**7**	**11**	**5**	**2**	**26**	**17**	**3**	**6**	**3**		**21**	**5**	**1**	**11**	**3**	**44**	**23**
Ontario																				
Enteritidis	274 (34.1)	164	97	4	9			9	6					11	2		4	5	108	11
Typhimurium	113 (14.1)	67	10	13	22	1	1	35	27	4	4	4		34	7		21	1	3	30
Typhi	104 (13)	11	71	6	16			17	15		1			15	12	1	10	30	93	6
Heidelberg	95 (11.8)	52	32	11			6	35	9	7	7	8		8	2	1	2			1
Other serovars	78 (9.7)	64	4	2	6	2	2	10	10	3	4	3		8	3	1	5	3	6	8
Newport	68 (8.5)	60	1	1	3	3	1	7	5	1	1	1		7	4	2	5		4	6
4,[5],12:i:-	57 (7.1)	15	2	8	29	3	4	37	34		3			39	9	3	8	1	6	37
Paratyphi A and B	14 (1.7)	2	11		1			1		1		1					1	3	12	1
Total	**803 (100)**	**435**	**228**	**45**	**86**	**9**	**14**	**151**	**106**	**16**	**20**	**17**		**122**	**39**	**8**	**56**	**43**	**232**	**100**

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, 2017 (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	131 (37.1)	66	61	1	3			4	2		1	1		3			2	5	61	4
Typhimurium	64 (18.1)	28	2	7	25	2		30	29	2	1	2		33	6		27		4	31
Heidelberg	56 (15.9)	27	22	7			1	24	8	7	7	6		4	2		1			
Other serovars	37 (10.5)	20	7		5	5	2	11	8	4	8	4		10	3		9	1	10	12
4,[5],12:i:-	34 (9.6)	10	2	6	16		2	20	18	1	1			19	2	1	3	3	4	20
Newport	16 (4.5)	12		2	1	1		3	3					2	3	2	2		1	2
Typhi	12 (3.4)	4	7	1				1										2	8	
Paratyphi A and B	3 (0.8)	2	1																1	
Total	**353 (100)**	**169**	**102**	**24**	**50**	**8**	**5**	**93**	**68**	**14**	**18**	**13**		**71**	**16**	**3**	**44**	**11**	**89**	**69**
New Brunswick																				
Enteritidis	96 (70.1)	62	30	3	1			3	3					2			1	1	30	3
Heidelberg	23 (16.8)	10	8	5				11	5	5	5	5		1	1					1
Typhimurium	10 (7.3)	4	1	2	3			6	4		1			5			3			3
Other serovars	5 (3.6)	4	1																	1
Newport	3 (2.2)	2				1		1	1					1	1	1	1			1
Total	**137 (100)**	**82**	**40**	**10**	**4**	**1**		**21**	**13**	**5**	**6**	**5**		**9**	**2**	**1**	**5**	**1**	**30**	**9**
Nova Scotia																				
Enteritidis	103 (72.5)	64	38		1			1						1			1	2	39	1
Heidelberg	17 (12)	8	3	6				9	3	2	2	2		3	3		2			
Typhimurium	9 (6.3)	7	1	1				1						1					1	1
Other serovars	8 (5.6)	7	1						1	1	1	1								
4,[5],12:i:-	3 (2.1)			3										3						3
Newport	2 (1.4)	2																		
Total	**142 (100)**	**88**	**43**	**10**	**1**			**11**	**4**	**3**	**3**	**3**		**8**	**3**		**3**	**2**	**40**	**5**
Prince Edward Island																				
Enteritidis	14 (63.6)	9	5															2	5	
Heidelberg	4 (18.2)	1		3			1	3						2	1				1	
Typhimurium	4 (18.2)	3		1				1						1						1
Total	**22 (100)**	**13**	**5**	**4**			**1**	**4**						**3**	**1**			**2**	**6**	**1**
Newfoundland and Labrador																				
Enteritidis	32 (64)	27	5																5	
Heidelberg	9 (18)	2	5	2				4	5	5	5	5								
Typhimurium	6 (12)	2			4			4	4	1				4			4			4
Newport	2 (4)	2																		
Other serovars	1 (2)	1																		
Total	**50 (100)**	**34**	**10**	**2**	**4**			**8**	**9**	**6**	**5**	**5**		**4**			**4**		**5**	**4**
National																				
Enteritidis	1043 (45)	704	303	18	18			21	17		2	1		23	4	1	11	18	320	33
Typhimurium	321 (13.9)	178	25	33	78	7	3	115	94	11	8	8		114	16		81	2	16	104
Heidelberg	250 (10.8)	119	90	39	2		12	105	40	31	31	30		23	11	1	6		2	4
Typhi	199 (8.6)	22	138	14	25			35	23		1			24	21	1	17	42	176	7
Other serovars	185 (8)	132	17	6	18	12	12	35	33	14	23	15		31	10	2	22	10	28	34
4,[5],12:i:-	142 (6.1)	33	11	22	66	10	9	89	80	1	6	1		90	17	4	21	7	21	97
Newport	139 (6)	118	4	3	7	7	1	16	13	3	3	3		15	11	8	13		7	14
Paratyphi A and B	38 (1.6)	7	28	2	1			3		1		1					2	10	31	1
Total	**2317 (100)**	**1313**	**616**	**137**	**215**	**36**	**37**	**419**	**300**	**61**	**74**	**59**		**320**	**90**	**17**	**173**	**89**	**601**	**294**

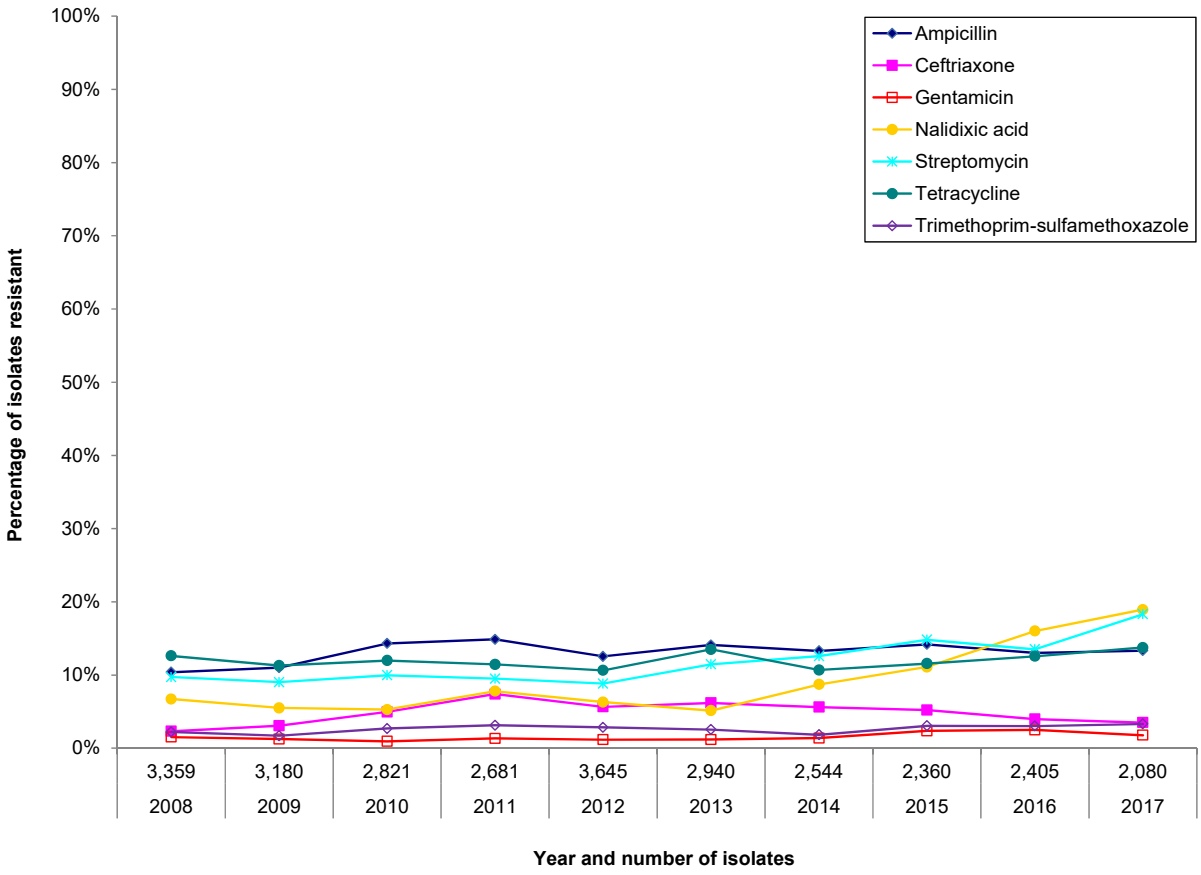
Antimicrobial abbreviations are defined in the Appendix.

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

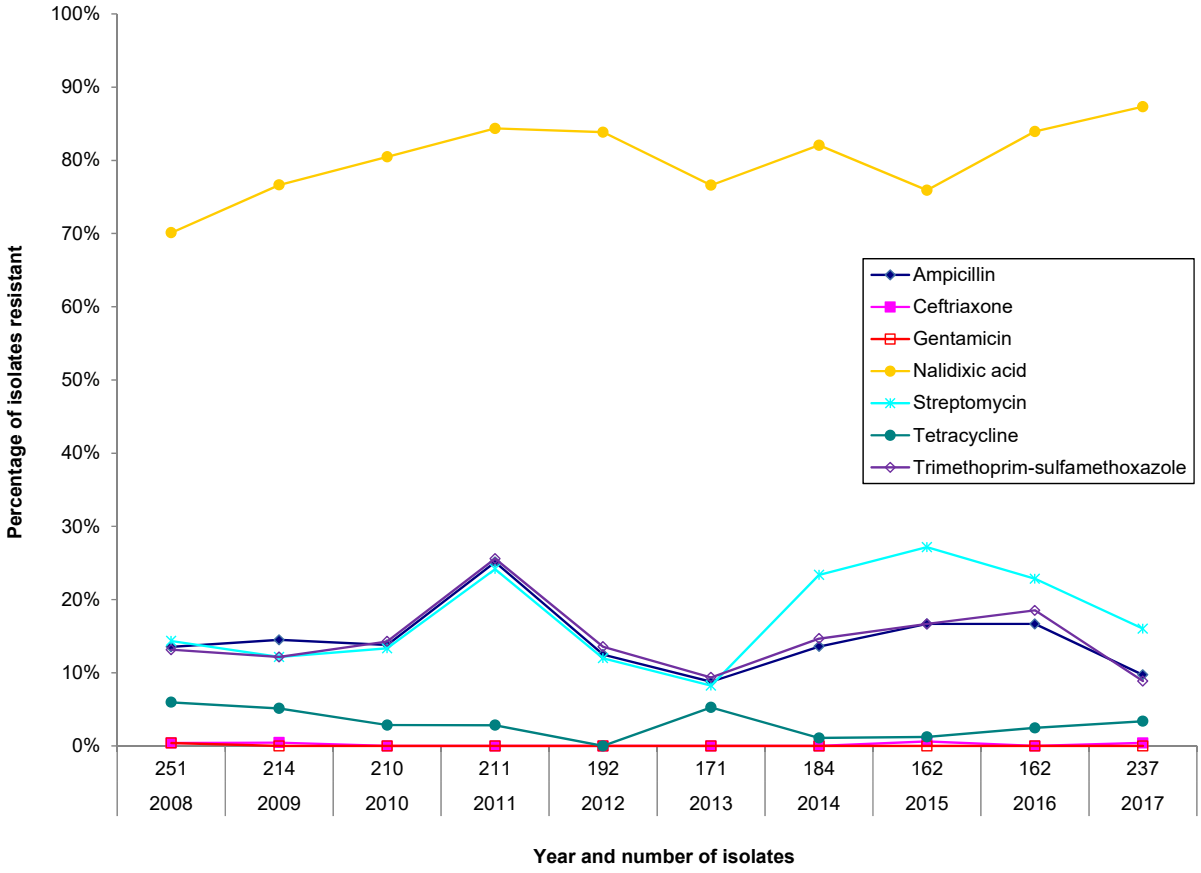
Figure 3. 2 Temporal variations in resistance of non-typhoidal *Salmonella* from humans, 2008 to 2017



Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of isolates	3,359	3,180	2,821	2,681	3,645	2,940	2,544	2,360	2,405	2,080
Antimicrobial										
Ampicillin	**10%**	11%	14%	15%	13%	14%	13%	14%	**13%**	**13%**
Ceftriaxone	**2%**	3%	5%	7%	6%	6%	6%	5%	**4%**	**4%**
Gentamicin	**2%**	1%	1%	1%	1%	1%	1%	2%	**2%**	**2%**
Nalidixic acid	**7%**	6%	5%	8%	6%	5%	9%	11%	**16%**	**19%**
Streptomycin	**10%**	9%	10%	10%	9%	11%	13%	15%	**14%**	**18%**
Tetracycline	**13%**	11%	12%	11%	11%	14%	11%	12%	**13%**	**14%**
Trimethoprim-sulfamethoxazole	**2%**	2%	3%	3%	3%	3%	2%	3%	**3%**	**3%**

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.

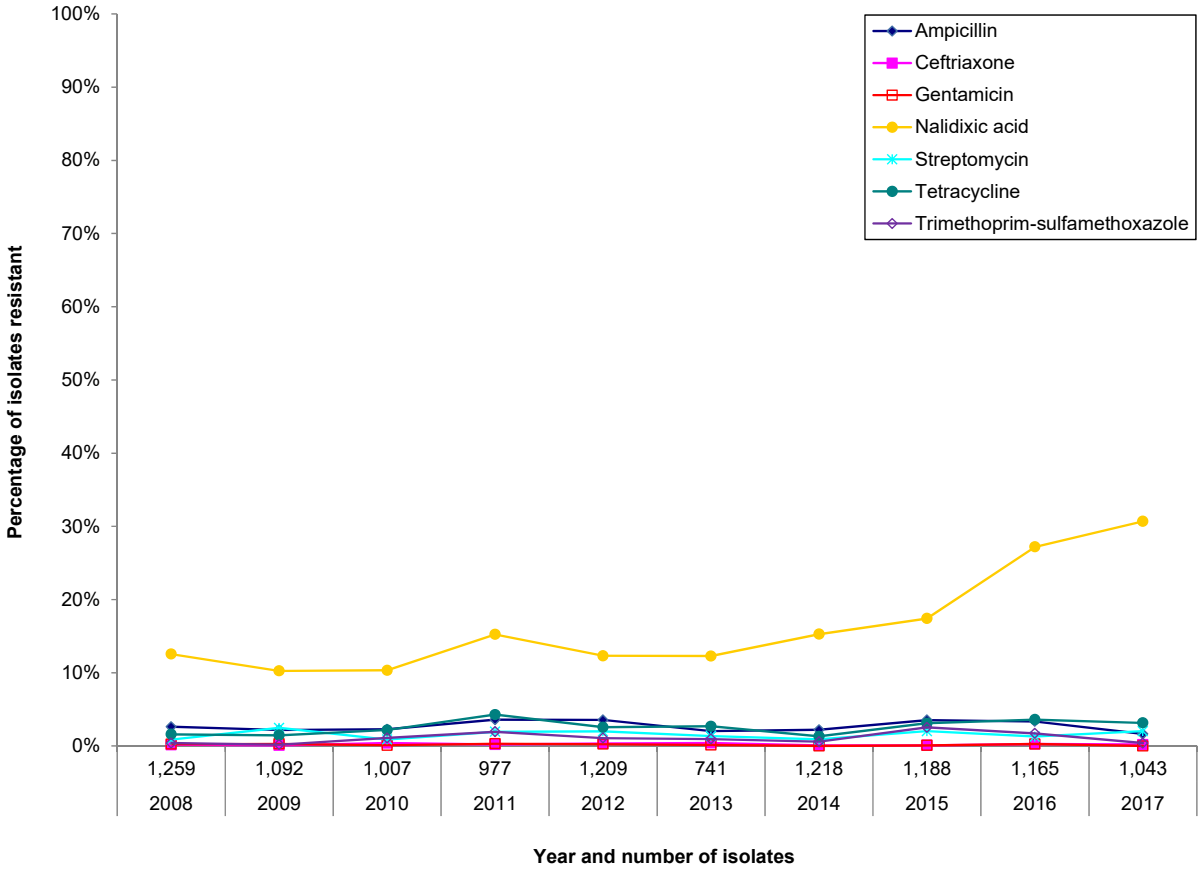
Figure 3. 3 Temporal variations in resistance of typhoidal *Salmonella* from humans, 2008 to 2017



Year Number of isolates	2008 251	2009 214	2010 210	2011 211	2012 192	2013 171	2014 184	2015 162	2016 162	2017 237
Antimicrobial										
Ampicillin	**14%**	14%	14%	25%	13%	9%	14%	17%	**17%**	**10%**
Ceftriaxone	**0%**	0%	0%	0%	0%	0%	0%	1%	**0%**	**0%**
Gentamicin	**0%**	0%	0%	0%	0%	0%	0%	0%	**0%**	**0%**
Nalidixic acid	**70%**	77%	80%	84%	84%	77%	82%	76%	**84%**	**87%**
Streptomycin	**14%**	12%	13%	24%	12%	8%	23%	27%	**23%**	**16%**
Tetracycline	**6%**	5%	3%	3%	0%	5%	1%	1%	**2%**	**3%**
Trimethoprim-sulfamethoxazole	**13%**	12%	14%	26%	14%	9%	15%	17%	**19%**	**9%**

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.

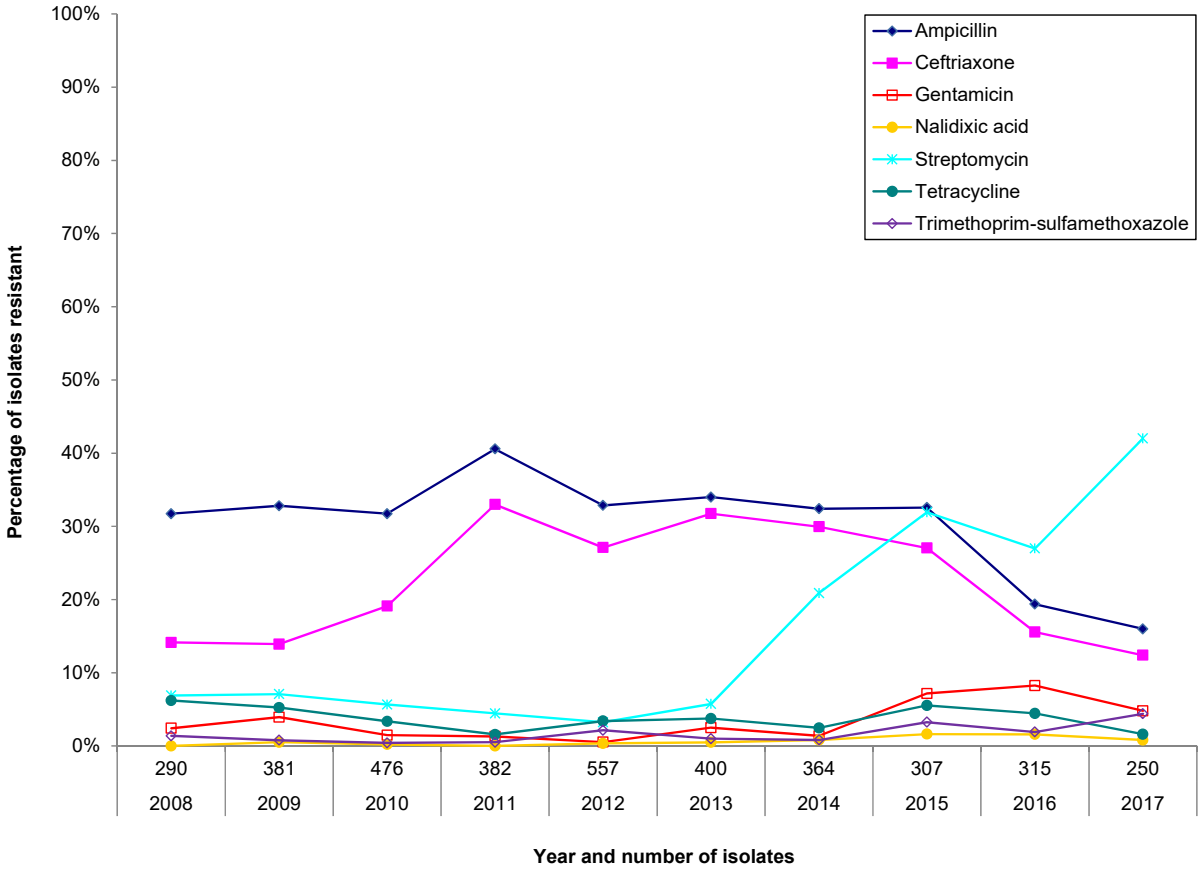
Figure 3. 4 Temporal variations in resistance of *Salmonella* Enteritidis from humans, 2008 to 2017



Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of isolates	1,259	1,092	1,007	977	1,209	741	1,218	1,188	1,165	1,043
Antimicrobial										
Ampicillin	**3%**	2%	2%	4%	4%	2%	2%	4%	**3%**	**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	**13%**	10%	10%	15%	12%	12%	15%	17%	**27%**	**31%**
Streptomycin	**1%**	2%	1%	2%	2%	1%	1%	2%	**1%**	**2%**
Tetracycline	**2%**	1%	2%	4%	3%	3%	1%	3%	**4%**	**3%**
Trimethoprim-sulfamethoxazole	**0%**	0%	1%	2%	1%	1%	1%	3%	**2%**	**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.

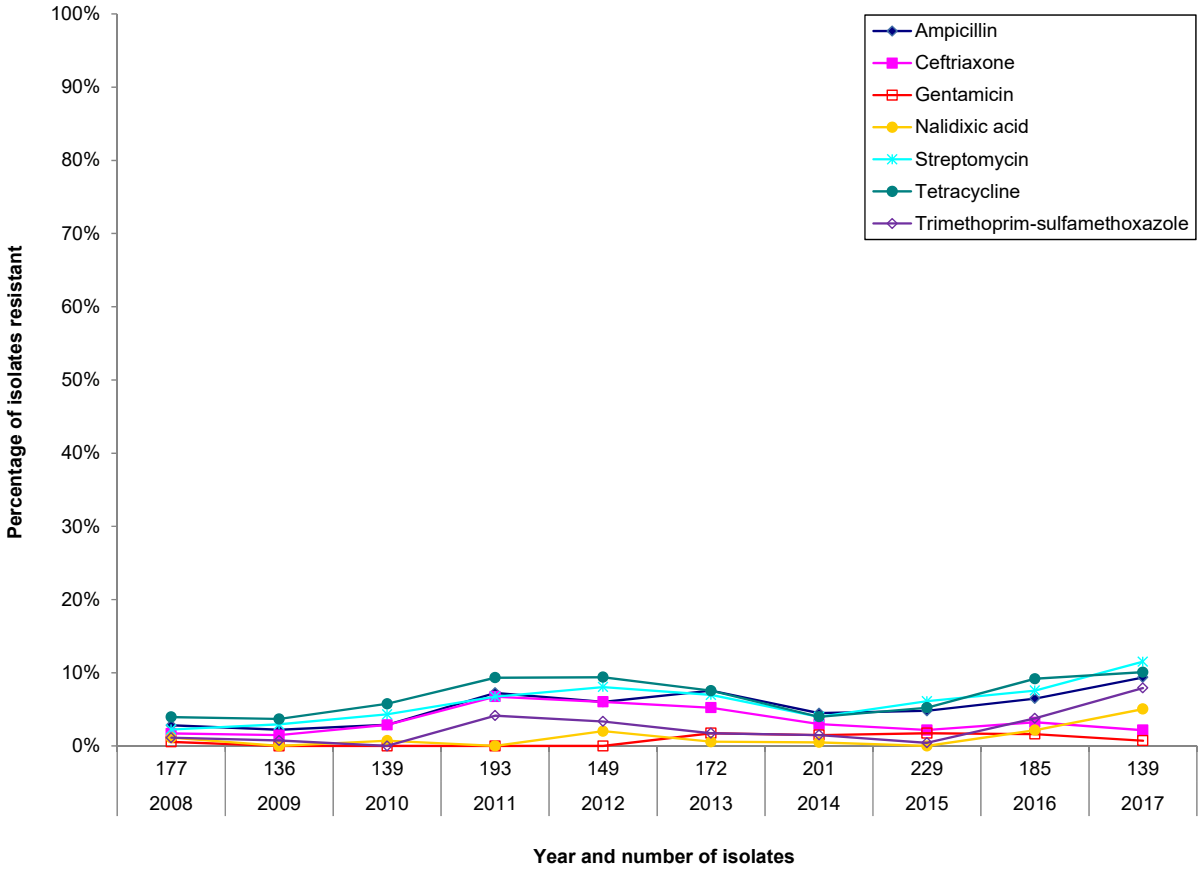
Figure 3. 5 Temporal variations in resistance of *Salmonella* Heidelberg from humans, 2008 to 2017



Year Number of isolates	2008 290	2009 381	2010 476	2011 382	2012 557	2013 400	2014 364	2015 307	2016 315	2017 250
Antimicrobial										
Ampicillin	**32%**	33%	32%	41%	33%	34%	32%	33%	**19%**	**16%**
Ceftriaxone	**14%**	14%	19%	33%	27%	32%	30%	27%	**16%**	**12%**
Gentamicin	**2%**	4%	1%	1%	1%	3%	1%	7%	**8%**	**5%**
Nalidixic acid	**0%**	1%	0%	0%	0%	1%	1%	2%	**2%**	**1%**
Streptomycin	**7%**	7%	6%	4%	3%	6%	21%	32%	**27%**	**42%**
Tetracycline	**6%**	5%	3%	2%	3%	4%	2%	6%	**4%**	**2%**
Trimethoprim-sulfamethoxazole	**1%**	1%	0%	1%	2%	1%	1%	3%	**2%**	**4%**

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.

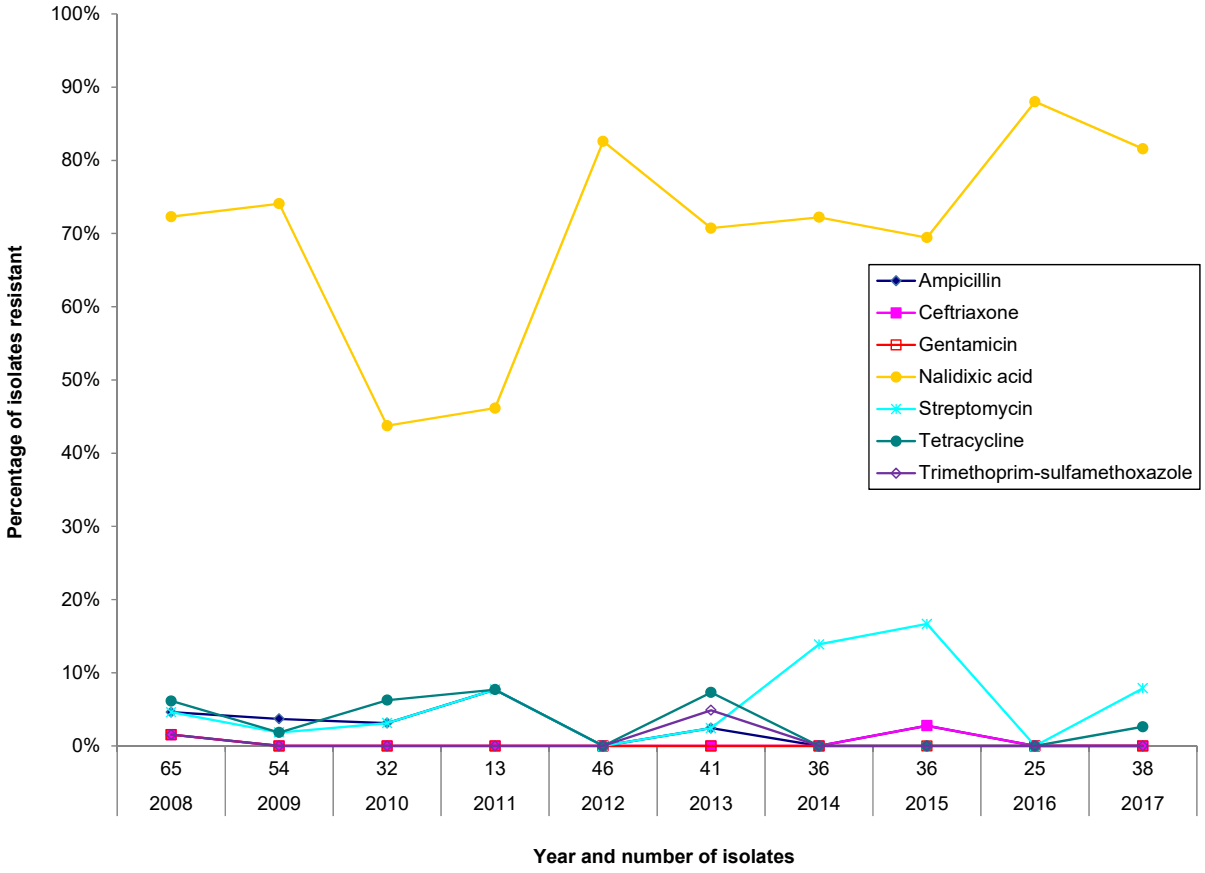
Figure 3. 6 Temporal variations in resistance of *Salmonella* Newport from humans, 2008 to 2017



Year Number of isolates	2008 177	2009 136	2010 139	2011 193	2012 149	2013 172	2014 201	2015 229	2016 185	2017 139
Antimicrobial										
Ampicillin	**3%**	2%	3%	7%	6%	8%	4%	5%	**6%**	**9%**
Ceftriaxone	**2%**	1%	3%	7%	6%	5%	3%	2%	**3%**	**2%**
Gentamicin	**1%**	0%	0%	0%	0%	2%	1%	2%	**2%**	**1%**
Nalidixic acid	**1%**	0%	1%	0%	2%	1%	0%	0%	**2%**	**5%**
Streptomycin	**2%**	3%	4%	7%	8%	7%	4%	6%	**8%**	**12%**
Tetracycline	**4%**	4%	6%	9%	9%	8%	4%	5%	**9%**	**10%**
Trimethoprim-sulfamethoxazole	**1%**	1%	0%	4%	3%	2%	1%	0%	**4%**	**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.

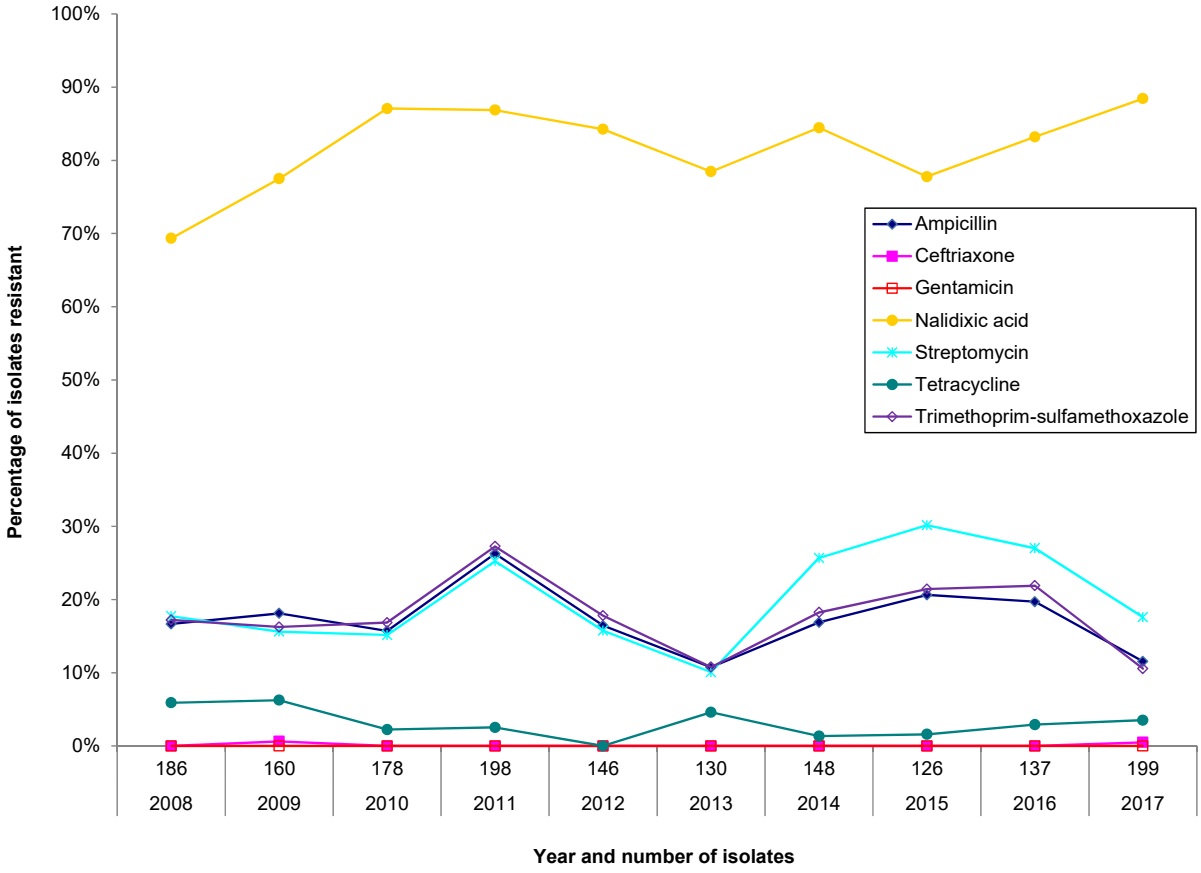
Figure 3. 7 Temporal variations in resistance of *Salmonella* Paratyphi A and B from humans, 2008 to 2017



Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of isolates	65	54	32	13	46	41	36	36	25	38
Antimicrobial										
Ampicillin	**5%**	4%	3%	8%	0%	2%	0%	3%	**0%**	**0%**
Ceftriaxone	**2%**	0%	0%	0%	0%	0%	0%	3%	**0%**	**0%**
Gentamicin	**2%**	0%	0%	0%	0%	0%	0%	0%	**0%**	**0%**
Nalidixic acid	**72%**	74%	44%	46%	83%	71%	72%	69%	**88%**	**82%**
Streptomycin	**5%**	2%	3%	8%	0%	2%	14%	17%	**0%**	**8%**
Tetracycline	**6%**	2%	6%	8%	0%	7%	0%	0%	**0%**	**3%**
Trimethoprim-sulfamethoxazole	**2%**	0%	0%	0%	0%	5%	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.

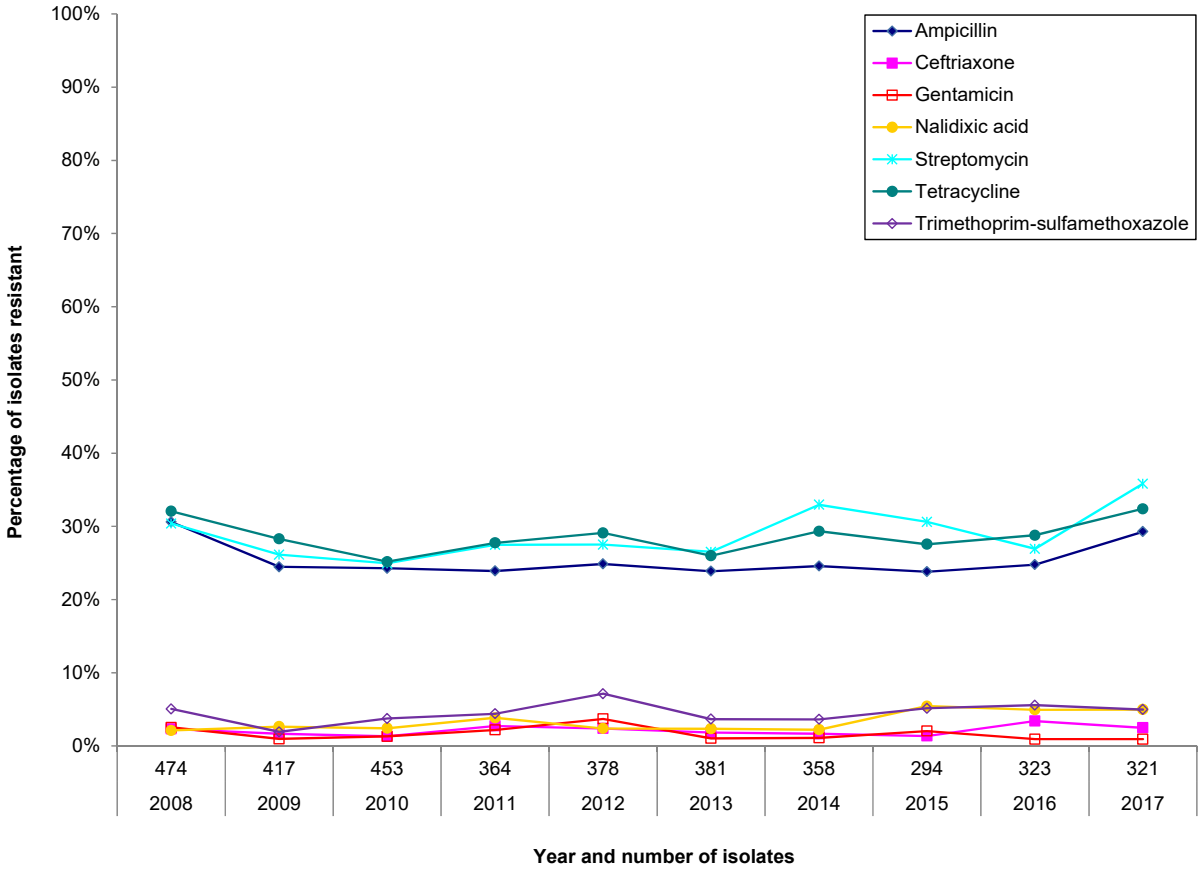
Figure 3. 8 Temporal variations in resistance of *Salmonella* Typhi from humans, 2008 to 2017



Year Number of isolates	2008 186	2009 160	2010 178	2011 198	2012 146	2013 130	2014 148	2015 126	2016 137	2017 199
Antimicrobial										
Ampicillin	**17%**	18%	16%	26%	16%	11%	17%	21%	**20%**	**12%**
Ceftriaxone	**0%**	1%	0%	0%	0%	0%	0%	0%	**0%**	**1%**
Gentamicin	**0%**	0%	0%	0%	0%	0%	0%	0%	**0%**	**0%**
Nalidixic acid	**69%**	78%	87%	87%	84%	78%	84%	78%	**83%**	**88%**
Streptomycin	**18%**	16%	15%	25%	16%	10%	26%	30%	**27%**	**18%**
Tetracycline	**6%**	6%	2%	3%	0%	5%	1%	2%	**3%**	**4%**
Trimethoprim-sulfamethoxazole	**17%**	16%	17%	27%	18%	11%	18%	21%	**22%**	**11%**

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.

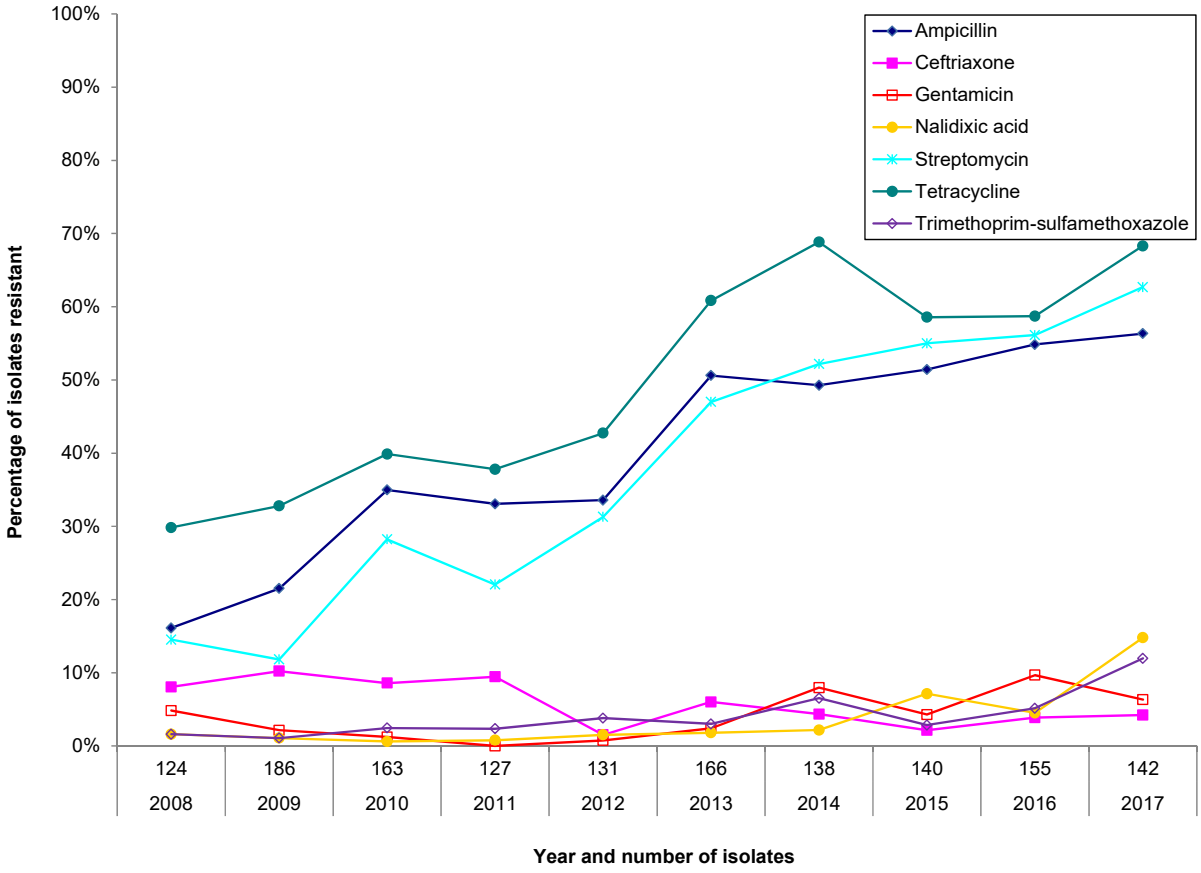
Figure 3. 9 Temporal variations in resistance of *Salmonella* Typhimurium from humans, 2008 to 2017



Year Number of isolates	2008 474	2009 417	2010 453	2011 364	2012 378	2013 381	2014 358	2015 294	2016 323	2017 321
Antimicrobial										
Ampicillin	**31%**	24%	24%	24%	25%	24%	25%	24%	**25%**	**29%**
Ceftriaxone	**2%**	2%	1%	3%	2%	2%	2%	1%	**3%**	**2%**
Gentamicin	**3%**	1%	1%	2%	4%	1%	1%	2%	**1%**	**1%**
Nalidixic acid	**2%**	3%	2%	4%	2%	2%	2%	5%	**5%**	**5%**
Streptomycin	**30%**	26%	25%	27%	28%	27%	33%	31%	**27%**	**36%**
Tetracycline	**32%**	28%	25%	28%	29%	26%	29%	28%	**29%**	**32%**
Trimethoprim-sulfamethoxazole	**5%**	2%	4%	4%	7%	4%	4%	5%	**6%**	**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. 10 Temporal variations in resistance of *Salmonella* 4,[5],12:i:- from humans, 2008 to 2017



Year Number of isolates	2008 124	2009 186	2010 163	2011 127	2012 131	2013 166	2014 138	2015 140	2016 155	2017 142
Antimicrobial										
Ampicillin	**16%**	22%	35%	33%	34%	51%	49%	51%	**55%**	**56%**
Ceftriaxone	**8%**	10%	9%	9%	2%	6%	4%	2%	**4%**	**4%**
Gentamicin	**5%**	2%	1%	0%	1%	2%	8%	4%	**10%**	**6%**
Nalidixic acid	**2%**	1%	1%	1%	2%	2%	2%	7%	**5%**	**15%**
Streptomycin	**15%**	12%	28%	22%	31%	47%	52%	55%	**56%**	**63%**
Tetracycline	**30%**	33%	40%	38%	43%	61%	69%	59%	**59%**	**68%**
Trimethoprim-sulfamethoxazole	**2%**	1%	2%	2%	4%	3%	7%	3%	**5%**	**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, 2017

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	59 (27.1)	55	2	1	1		1	1	1					2	1		1	1	1	3
Prairies	13 (6.0)	11	1	1				1												2
Ontario	64 (29.4)	44	9	2	9			8	8					9	1	1	8		2	19
Québec	82 (37.6)	66	4	9	3		1	11	6					5	2		2			14
National	**218 (100)**	**176**	**16**	**13**	**13**		**2**	**21**	**15**					**16**	**4**	**1**	**11**	**1**	**3**	**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.

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

For Ontario and the Prairies in 2017, 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, 2017

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	36 (65.5)	36																		
Kentucky	12 (21.8)	1		9	2			11	3	3	3	2							2	11
Less common serovars	7 (12.7)	5	2					1	1											
Total	**55 (100)**	**42**	**2**	**9**	**2**			**12**	**4**	**3**	**3**	**2**							**2**	**11**
Prairies																				
Enteritidis	5 (62.5)	5																		
Kentucky	1 (12.5)			1				1												1
Senftenberg	1 (12.5)	1																		
Typhimurium	1 (12.5)	1																		
Total	**8 (100)**	**7**		**1**				**1**												**1**
Ontario																				
Kentucky	9 (39.1)			9				9	1	1	1									9
Heidelberg	7 (30.4)	1	3	3			2	4	3	1	1	1		2	1					
Braenderup	1 (4.3)	1																		
Hadar	1 (4.3)	1																		
4,5,12:i:-	1 (4.3)	1																		
8,20:-:z6	1 (4.3)			1			1	1						1						1
Indiana	1 (4.3)	1																		
Infantis	1 (4.3)	1																		
Livingstone	1 (4.3)		1																	1
Total	**23 (100)**	**6**	**4**	**13**			**3**	**14**	**4**	**2**	**2**	**1**		**3**	**1**					**11**
Québec																				
Kentucky	27 (33.3)	2		25				25	3	3	3	3		1	1					25
Heidelberg	23 (28.4)	15	4	4			3	6	3	2	2	2		3						
Enteritidis	8 (9.9)	8																		
Thompson	7 (8.6)	7																		
Hadar	4 (4.9)	2		2				2												2
Braenderup	2 (2.5)	2																		
Schwarzengrund	2 (2.5)	1		1				1						1						1
Typhimurium	2 (2.5)	1		1			1	1						1						1
Less common serovars	6 (7.4)	5	1																	1
Total	**81 (100)**	**43**	**5**	**33**			**4**	**35**	**6**	**5**	**5**	**5**		**6**	**1**					**30**
National																				
Enteritidis	49 (29.3)	49																		
Kentucky	49 (29.3)	3		44	2			46	7	7	7	5		1	1				2	46
Heidelberg	30 (18.0)	16	7	7			5	10	6	3	3	3		5	1					
Thompson	8 (4.8)	8																		
Hadar	5 (3.0)	3		2				2												2
Braenderup	4 (2.4)	4																		
Less common serovars	22 (13.2)	15	4	3			2	4	1					3						5
Total	**167 (100)**	**98**	**11**	**56**	**2**		**7**	**62**	**14**	**10**	**10**	**8**		**9**	**2**				**2**	**53**

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 2017, 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, 2017

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	77 (26.3)	20	9	29	19		11	35	42	6	6	6		29	3		2		9	34
Prairies	15 (5.1)	6	1	6	2		3	7	4	1		1		5	2				2	8
Ontario	76 (25.9)	25	15	28	8		18	30	19	3	4	3		25	10		4			34
Québec	125 (42.7)	28	5	67	25		44	76	52	9	9	9		67	24		7	1	1	71
National	**293 (100)**	**79**	**30**	**130**	**54**		**76**	**148**	**117**	**19**	**19**	**19**		**126**	**39**		**13**	**1**	**12**	**147**

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 2017, 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, 2017

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	43 (58.1)	21	11	11									14	14	19
Campylobacter spp.	28 (37.8)	13	9	6									9	9	12
Campylobacter coli	3 (4.1)	2		1									1	1	1
Total	**74 (100)**	**36**	**20**	**18**									**24**	**24**	**32**
Prairies															
Campylobacter jejuni	9 (90.0)	4	3	2									2	2	5
Campylobacter spp.	1 (10.0)			1									1	1	1
Total	**10 (100)**	**4**	**3**	**3**									**3**	**3**	**6**
Ontario															
Campylobacter jejuni	21 (72.4)	12	9												9
Campylobacter spp.	8 (27.6)	4	4										1	1	3
Total	**29 (100)**	**16**	**13**										**1**	**1**	**12**
Québec															
Campylobacter jejuni	29 (55.8)	17	6	6					6	6	6				6
Campylobacter spp.	20 (38.5)	12	5	3				1	1	1	1		2	2	7
Campylobacter coli	3 (5.8)	1	1	1									1	1	2
Total	**52 (100)**	**30**	**12**	**10**				**1**	**7**	**7**	**7**		**3**	**3**	**15**
National															
Campylobacter jejuni	102 (61.8)	54	29	19					6	6	6		16	16	39
Campylobacter spp.	57 (34.5)	29	18	10				1	1	1	1		13	13	23
Campylobacter coli	6 (3.6)	3	1	2									2	2	3
Total	**165 (100)**	**86**	**48**	**31**				**1**	**7**	**7**	**7**		**31**	**31**	**65**

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 is a region including the provinces of Alberta and Saskatchewan.

For Ontario and the Prairies in 2017, 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, 2017

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	25 (21.7)	20	2	2	1			2	2					3						4
Prairies	2 (1.7)	2																		
Ontario	53 (46.1)	22	7	17	7			19	16	1	1	1		15	3		4		1	26
Québec	35 (30.4)	20	4	9	2		1	7	5	2	1	1		9	4		2			14
National	**115 (100)**	**64**	**13**	**28**	**10**		**1**	**28**	**23**	**3**	**2**	**2**		**27**	**7**		**6**		**1**	**44**

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 2017, 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, 2017

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	16 (39)	10	3	2	1			3	3					3			1			3
Enteritidis	11 (26.8)	11																		
Hadar	7 (17.1)	1		6				6	3											6
Agona	1 (2.4)			1					1		1			1						1
Anatum	1 (2.4)	1																		
Cubana	1 (2.4)	1																		
Heidelberg	1 (2.4)			1			1	1						1						1
Kentucky	1 (2.4)			1				1												1
Saintpaul	1 (2.4)			1			1	1	1					1						
Worthington	1 (2.4)			1				1						1						1
Total	**41 (100)**	**24**	**3**	**13**	**1**		**2**	**13**	**8**		**1**			**7**			**1**			**13**
Prairies																				
Reading	3 (100)	3																		
Total	**3 (100)**	**3**																		
Ontario																				
Heidelberg	5 (29.4)	4		1			1	1						1						
Reading	4 (23.5)	2			2			2	2					2						2
Albany	2 (11.8)	1	1					1												
Muenchen	2 (11.8)	1		1				1						1						1
Braenderup	1 (5.9)	1																		
Hadar	1 (5.9)			1				1												1
Schwarzengrund	1 (5.9)	1																		
Uganda	1 (5.9)			1				1						1						1
Total	**17 (100)**	**10**	**1**	**4**	**2**		**1**	**7**	**2**					**5**						**5**
Québec																				
Heidelberg	12 (30)	8		4			4	4	1					4						
Schwarzengrund	9 (22.5)	4		5			1	5	1					4						5
Muenchen	5 (12.5)	3	1	1			1	1												1
Bredeney	2 (5)		1	1			2	1	1	1	1			1						
Hadar	2 (5)		1	1				2												1
Reading	2 (5)	2																		
Agona	1 (2.5)			1			1	1						1						
Albany	1 (2.5)	1																		
Brandenburg	1 (2.5)		1						1	1	1	1								
6,7:-:1,5	1 (2.5)	1																		
Infantis	1 (2.5)					1	1	1	1		1			1			1		1	1
Montevideo	1 (2.5)			1			1	1	1											
Thompson	1 (2.5)	1																		
Uganda	1 (2.5)			1				1						1						1
Total	**40 (100)**	**20**	**4**	**15**		**1**	**11**	**17**	**6**	**2**	**3**	**1**		**12**			**1**		**1**	**9**
National																				
Reading	25 (24.8)	17	3	2	3			5	5					5			1			5
Heidelberg	18 (17.8)	12		6			6	6	1					6						1
Enteritidis	11 (10.9)	11																		
Hadar	10 (9.9)	1	1	8				9	3											8
Schwarzengrund	10 (9.9)	5		5			1	5	1					4						5
Muenchen	7 (6.9)	4	1	2			1	2						1						2
Albany	3 (3)	2	1					1												
Less common serovars	17 (16.8)	5	2	9		1	6	9	6	2	4	1		8			1		1	6
Total	**101 (100)**	**57**	**8**	**32**	**3**	**1**	**14**	**37**	**16**	**2**	**4**	**1**		**24**			**2**		**1**	**27**

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 2017, 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, 2017

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	86 (29.9)	30	16	27	13		14	37	22	4	3	3		29	6		4			43
Prairies	13 (4.5)	5	1	5	2		1	6	4					3						8
Ontario	77 (26.7)	32	12	26	7		14	28	17	1		1		21	7		2	1	2	36
Québec	112 (38.9)	43	16	36	17		22	40	38	4	4	3		36	18	1	4	1	1	57
National	**288 (100)**	**110**	**45**	**94**	**39**		**51**	**111**	**81**	**9**	**7**	**7**		**89**	**31**	**1**	**10**	**2**	**3**	**144**

Antimicrobial abbreviations are defined in the Appendix.

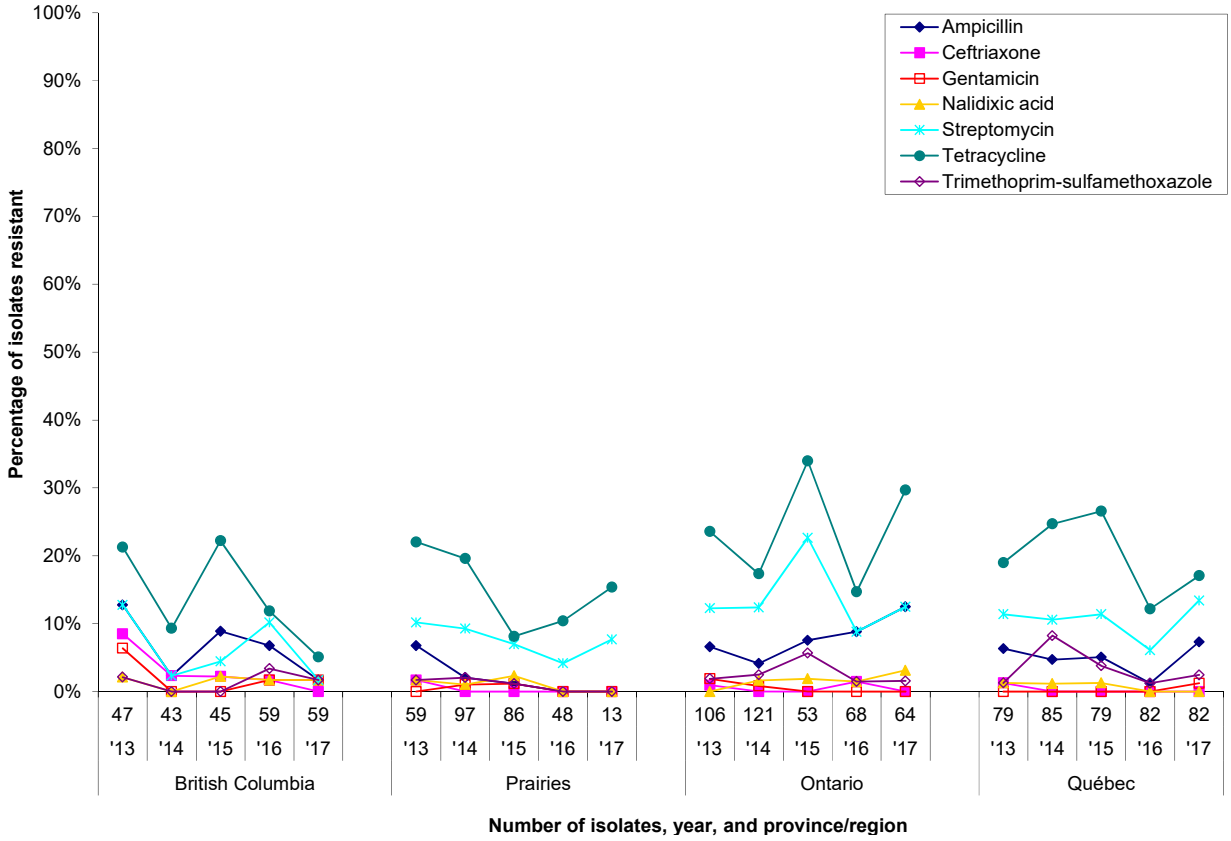
Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.

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

For Ontario and the Prairies in 2017, 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, 2013 to 2017



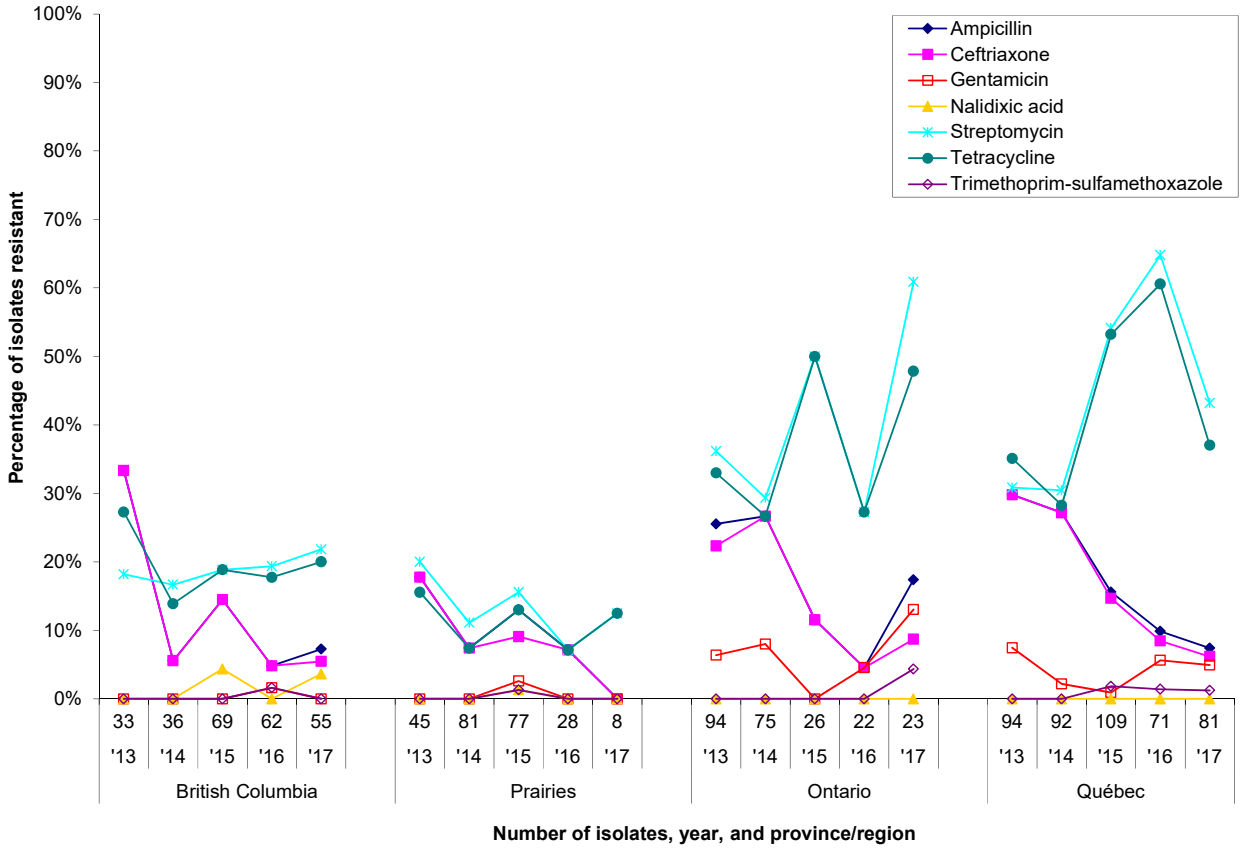
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	47	43	45	59	59	59	97	86	48	13	106	121	53	68	64	79	85	79	82	82
Antimicrobial																				
Ampicillin	**13%**	2%	9%	**7%**	**2%**	**7%**	2%	1%	**0%**	**0%**	**7%**	4%	8%	**9%**	**13%**	**6%**	5%	5%	**1%**	**7%**
Ceftriaxone	**9%**	2%	2%	**2%**	**0%**	**2%**	0%	0%	**0%**	**0%**	**1%**	0%	0%	**1%**	**0%**	**1%**	0%	0%	**0%**	**0%**
Gentamicin	**6%**	0%	0%	**2%**	**2%**	**0%**	1%	1%	**0%**	**0%**	**2%**	1%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**1%**
Nalidixic acid	**2%**	0%	2%	**2%**	**2%**	**2%**	1%	2%	**0%**	**0%**	**0%**	2%	2%	**1%**	**3%**	**1%**	1%	1%	**0%**	**0%**
Streptomycin	**13%**	2%	4%	**10%**	**2%**	**10%**	9%	7%	**4%**	**8%**	**12%**	12%	23%	**9%**	**13%**	**11%**	11%	11%	**6%**	**13%**
Tetracycline	**21%**	9%	22%	**12%**	**5%**	**22%**	20%	8%	**10%**	**15%**	**24%**	17%	34%	**15%**	**30%**	**19%**	25%	27%	**12%**	**17%**
Trimethoprim-sulfamethoxazole	**2%**	0%	0%	**3%**	**2%**	**2%**	2%	1%	**0%**	**0%**	**2%**	2%	6%	**1%**	**2%**	**1%**	8%	4%	**1%**	**2%**

For the temporal analyses by 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 2017, 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.

Figure 3. 12 Temporal variations in resistance of *Salmonella* isolates from chicken, 2013 to 2017



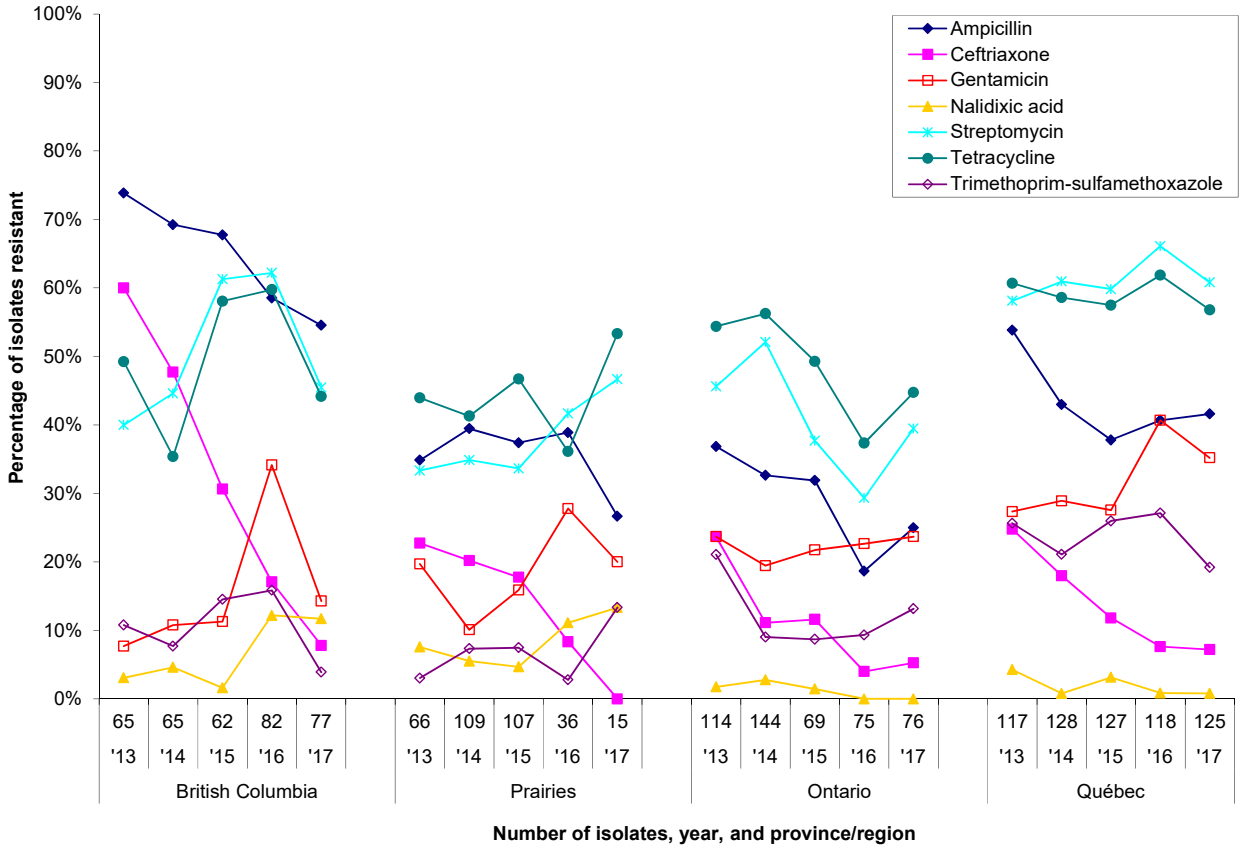
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	33	36	69	62	55	45	81	77	28	8	94	75	26	22	23	94	92	109	71	81
Antimicrobial																				
Ampicillin	**33%**	6%	14%	**5%**	**7%**	**18%**	7%	13%	**7%**	**0%**	**26%**	27%	12%	**5%**	**17%**	**30%**	27%	16%	**10%**	**7%**
Ceftriaxone	**33%**	6%	14%	**5%**	**5%**	**18%**	7%	9%	**7%**	**0%**	**22%**	27%	12%	**5%**	**9%**	**30%**	27%	15%	**8%**	**6%**
Gentamicin	**0%**	0%	0%	**2%**	**0%**	**0%**	0%	3%	**0%**	**0%**	**6%**	8%	0%	**5%**	**13%**	**7%**	2%	1%	**6%**	**5%**
Nalidixic acid	**0%**	0%	4%	**0%**	**4%**	**0%**	0%	1%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
Streptomycin	**18%**	17%	19%	**19%**	**22%**	**20%**	11%	16%	**7%**	**13%**	**36%**	29%	50%	**27%**	**61%**	**31%**	30%	54%	**65%**	**43%**
Tetracycline	**27%**	14%	19%	**18%**	**20%**	**16%**	7%	13%	**7%**	**13%**	**33%**	27%	50%	**27%**	**48%**	**35%**	28%	53%	**61%**	**37%**
Trimethoprim-sulfamethoxazole	**0%**	0%	0%	**2%**	**0%**	**0%**	0%	1%	**0%**	**0%**	**0%**	0%	0%	**0%**	**4%**	**0%**	0%	2%	**1%**	**1%**

For the temporal analyses by 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 2017, 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.

Figure 3. 13 Temporal variations in resistance of *Escherichia coli* isolates from chicken, 2013 to 2017



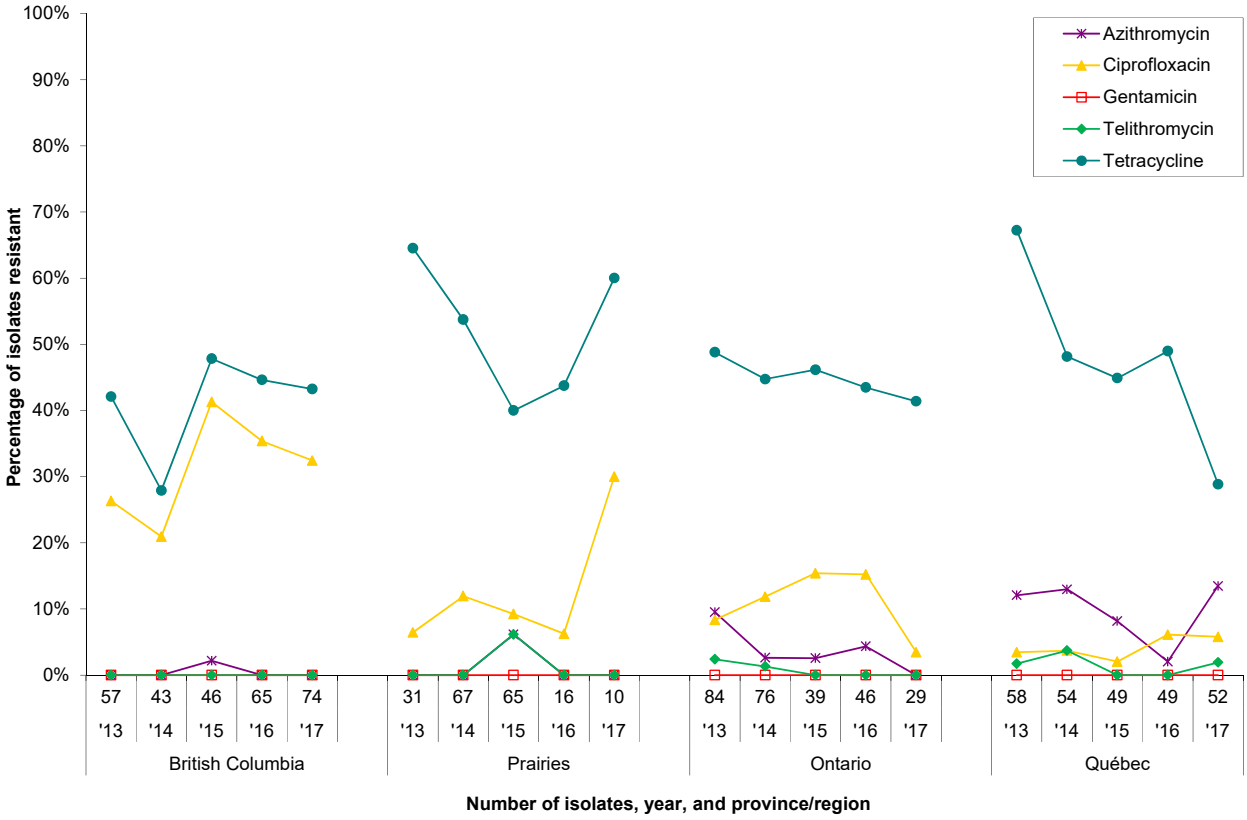
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	65	65	62	82	77	66	109	107	36	15	114	144	69	75	76	117	128	127	118	125
Antimicrobial																				
Ampicillin	**74%**	69%	68%	**59%**	**55%**	**35%**	39%	37%	**39%**	**27%**	**37%**	33%	32%	**19%**	**25%**	**54%**	43%	38%	**41%**	**42%**
Ceftriaxone	**60%**	48%	31%	**17%**	**8%**	**23%**	20%	18%	**8%**	**0%**	**24%**	11%	12%	**4%**	**5%**	**25%**	18%	12%	**8%**	**7%**
Gentamicin	**8%**	11%	11%	**34%**	**14%**	**20%**	10%	16%	**28%**	**20%**	**24%**	19%	22%	**23%**	**24%**	**27%**	29%	28%	**41%**	**35%**
Nalidixic acid	**3%**	5%	2%	**12%**	**12%**	**8%**	6%	5%	**11%**	**13%**	**2%**	3%	1%	**0%**	**0%**	**4%**	1%	3%	**1%**	**1%**
Streptomycin	**40%**	45%	61%	**62%**	**45%**	**33%**	35%	34%	**42%**	**47%**	**46%**	52%	38%	**29%**	**39%**	**58%**	61%	60%	**66%**	**61%**
Tetracycline	**49%**	35%	58%	**60%**	**44%**	**44%**	41%	47%	**36%**	**53%**	**54%**	56%	49%	**37%**	**45%**	**61%**	59%	57%	**62%**	**57%**
Trimethoprim-sulfamethoxazole	**11%**	8%	15%	**16%**	**4%**	**3%**	7%	7%	**3%**	**13%**	**21%**	9%	9%	**9%**	**13%**	**26%**	21%	26%	**27%**	**19%**

For the temporal analyses by 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 2017, 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.

Figure 3. 14 Temporal variations in resistance of *Campylobacter* isolates from chicken, 2013 to 2017



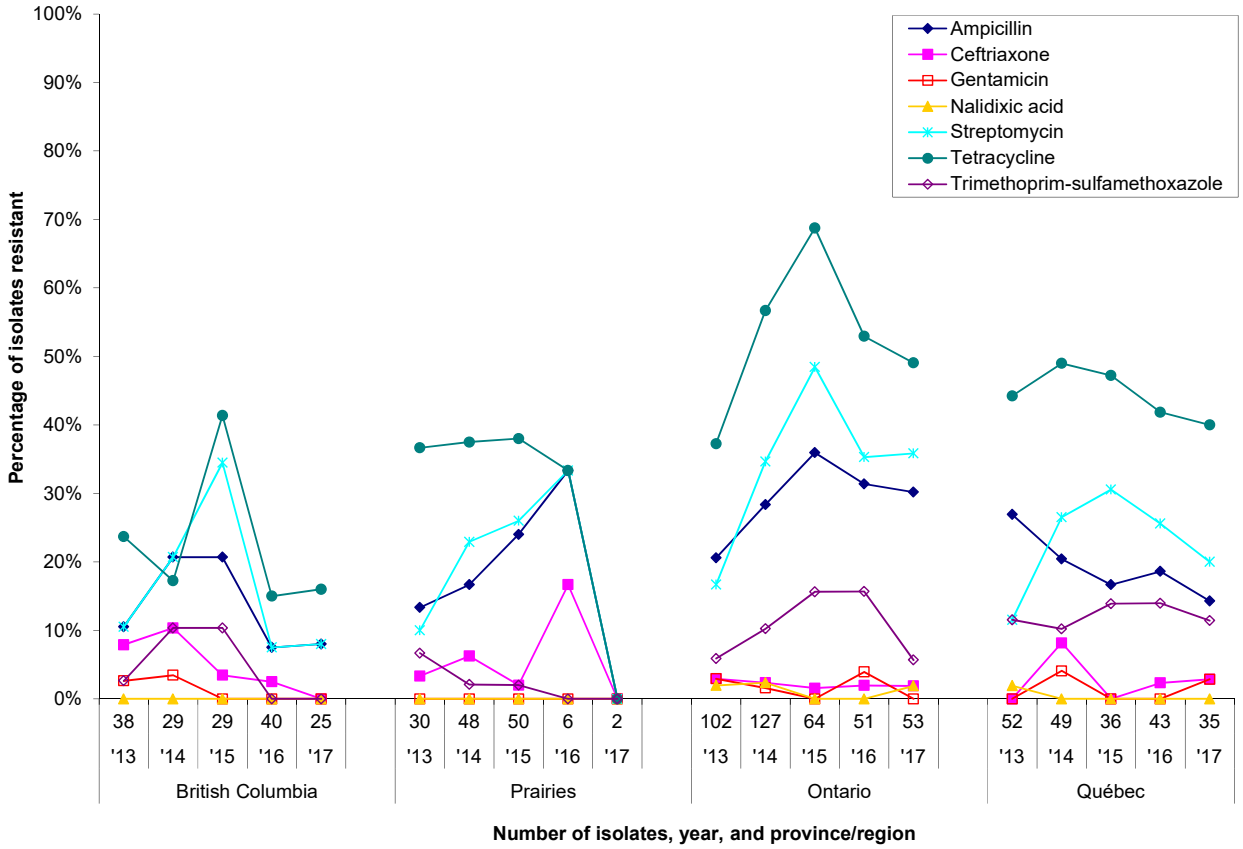
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	57	43	46	65	74	31	67	65	16	10	84	76	39	46	29	58	54	49	49	52
Antimicrobial																				
Azithromycin	**0%**	0%	2%	**0%**	**0%**	**0%**	0%	6%	**0%**	**0%**	**10%**	3%	3%	**4%**	**0%**	**12%**	13%	8%	**2%**	**13%**
Ciprofloxacin	**26%**	21%	41%	**35%**	**32%**	**6%**	12%	9%	**6%**	**30%**	**8%**	12%	15%	**15%**	**3%**	**3%**	4%	2%	**6%**	**6%**
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%**	0%	6%	**0%**	**0%**	**2%**	1%	0%	**0%**	**0%**	**2%**	4%	0%	**0%**	**2%**
Tetracycline	**42%**	28%	48%	**45%**	**43%**	**65%**	54%	40%	**44%**	**60%**	**49%**	45%	46%	**43%**	**41%**	**67%**	48%	45%	**49%**	**29%**

For the temporal analyses by 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 2017, 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.

Figure 3. 15 Temporal variations in resistance of *Escherichia coli* isolates from pork, 2013 to 2017



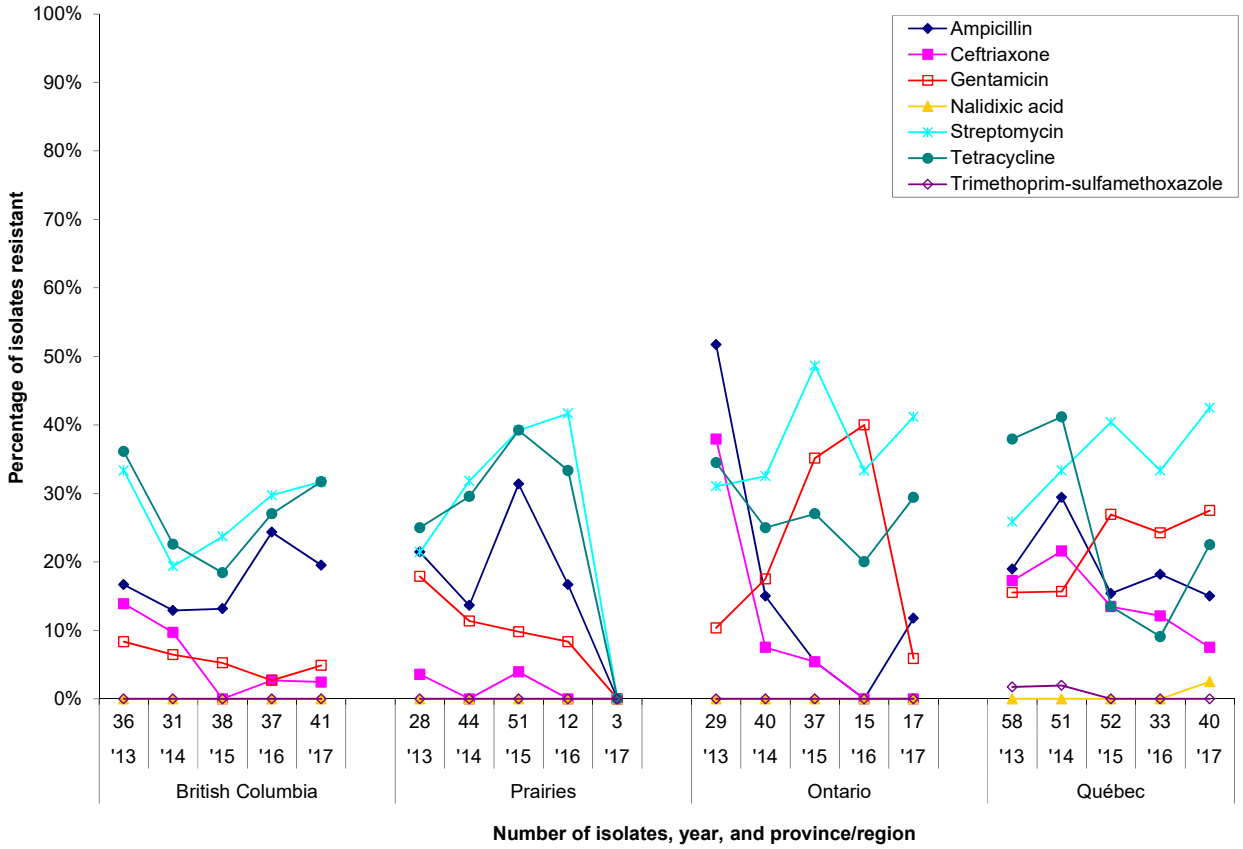
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	38	29	29	40	25	30	48	50	6	2	102	127	64	51	53	52	49	36	43	35
Antimicrobial																				
Ampicillin	**11%**	21%	21%	**8%**	**8%**	**13%**	17%	24%	**33%**	**0%**	**21%**	28%	36%	**31%**	**30%**	**27%**	20%	17%	**19%**	**14%**
Ceftriaxone	**8%**	10%	3%	**3%**	**0%**	**3%**	6%	2%	**17%**	**0%**	**3%**	2%	2%	**2%**	**2%**	**0%**	8%	0%	**2%**	**3%**
Gentamicin	**3%**	3%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**3%**	2%	0%	**4%**	**0%**	**0%**	4%	0%	**0%**	**3%**
Nalidixic acid	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**2%**	2%	0%	**0%**	**2%**	**2%**	0%	0%	**0%**	**0%**
Streptomycin	**11%**	21%	34%	**8%**	**8%**	**10%**	23%	26%	**33%**	**0%**	**17%**	35%	48%	**35%**	**36%**	**12%**	27%	31%	**26%**	**20%**
Tetracycline	**24%**	17%	41%	**15%**	**16%**	**37%**	38%	38%	**33%**	**0%**	**37%**	57%	69%	**53%**	**49%**	**44%**	49%	47%	**42%**	**40%**
Trimethoprim-sulfamethoxazole	**3%**	10%	10%	**0%**	**0%**	**7%**	2%	2%	**0%**	**0%**	**6%**	10%	16%	**16%**	**6%**	**12%**	10%	14%	**14%**	**11%**

For the temporal analyses by 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 2017, 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.

Figure 3. 16 Temporal variations in resistance of *Salmonella* isolates from turkey, 2013 to 2017



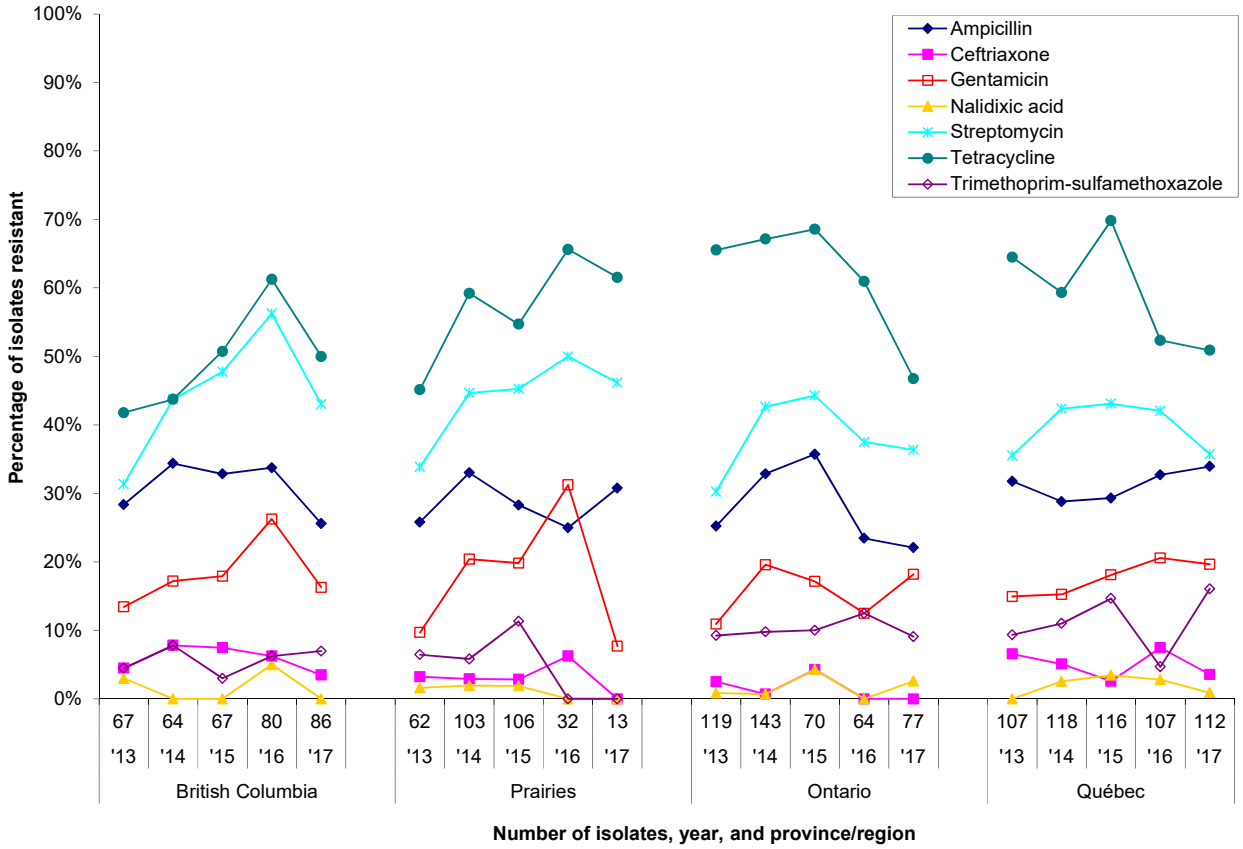
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	36	31	38	37	41	28	44	51	12	3	29	40	37	15	17	58	51	52	33	40
Antimicrobial																				
Ampicillin	**17%**	13%	13%	**24%**	**20%**	**21%**	14%	31%	**17%**	**0%**	**52%**	15%	5%	**0%**	**12%**	**19%**	29%	15%	**18%**	**15%**
Ceftriaxone	**14%**	10%	0%	**3%**	**2%**	**4%**	0%	4%	**0%**	**0%**	**38%**	8%	5%	**0%**	**0%**	**17%**	22%	13%	**12%**	**8%**
Gentamicin	**8%**	6%	5%	**3%**	**5%**	**18%**	11%	10%	**8%**	**0%**	**10%**	18%	35%	**40%**	**6%**	**16%**	16%	27%	**24%**	**28%**
Nalidixic acid	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**3%**
Streptomycin	**33%**	19%	24%	**30%**	**32%**	**21%**	32%	39%	**42%**	**0%**	**31%**	33%	49%	**33%**	**41%**	**26%**	33%	40%	**33%**	**43%**
Tetracycline	**36%**	23%	18%	**27%**	**32%**	**25%**	30%	39%	**33%**	**0%**	**34%**	25%	27%	**20%**	**29%**	**38%**	41%	13%	**9%**	**23%**
Trimethoprim-sulfamethoxazole	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**2%**	2%	0%	**0%**	**0%**

For the temporal analyses by 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 2017, 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.

Figure 3. 17 Temporal variations in resistance of *Escherichia coli* isolates from turkey, 2013 to 2017



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	67	64	67	80	86	62	103	106	32	13	119	143	70	64	77	107	118	116	107	112
Antimicrobial																				
Ampicillin	**28%**	34%	33%	**34%**	**26%**	**26%**	33%	28%	**25%**	**31%**	**25%**	33%	36%	**23%**	**22%**	**32%**	29%	29%	**33%**	**34%**
Ceftriaxone	**4%**	8%	7%	**6%**	**3%**	**3%**	3%	3%	**6%**	**0%**	**3%**	1%	4%	**0%**	**0%**	**7%**	5%	3%	**7%**	**4%**
Gentamicin	**13%**	17%	18%	**26%**	**16%**	**10%**	20%	20%	**31%**	**8%**	**11%**	20%	17%	**13%**	**18%**	**15%**	15%	18%	**21%**	**20%**
Nalidixic acid	**3%**	0%	0%	**5%**	**0%**	**2%**	2%	2%	**0%**	**0%**	**1%**	1%	4%	**0%**	**3%**	**0%**	3%	3%	**3%**	**1%**
Streptomycin	**31%**	44%	48%	**56%**	**43%**	**34%**	45%	45%	**50%**	**46%**	**30%**	43%	44%	**38%**	**36%**	**36%**	42%	43%	**42%**	**36%**
Tetracycline	**42%**	44%	51%	**61%**	**50%**	**45%**	59%	55%	**66%**	**62%**	**66%**	67%	69%	**61%**	**47%**	**64%**	59%	70%	**52%**	**51%**
Trimethoprim-sulfamethoxazole	**4%**	8%	3%	**6%**	**7%**	**6%**	6%	11%	**0%**	**0%**	**9%**	10%	10%	**13%**	**9%**	**9%**	11%	15%	**5%**	**16%**

For the temporal analyses by 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 2017, 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.

Table 3. 9 Retail Meat Surveillance recovery rates, 2003 to 2017

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				
	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				
	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				
	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				

See corresponding footnotes at the end of the table.

Table 3. 9 Retail Meat Surveillance recovery rates, 2003 to 2017 (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]								
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		
	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		
	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		

See corresponding footnotes at the end of the table.

Table 3. 9 Retail Meat Surveillance recovery rates, 2003 to 2017 (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		
	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]								
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						
	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						

See corresponding footnotes at the end of the table.

Table 3. 9 Retail Meat Surveillance recovery rates, 2003 to 2017 (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						
	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						
	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]								

See corresponding footnotes at the end of the table.

Table 3. 9 Retail Meat Surveillance recovery rates, 2003 to 2017 (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		
	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		
	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		
	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		
	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]								

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 2017, 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 2017.

Abattoir Surveillance

Multiclass resistance

Table 3. 10 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from beef cattle, 2017

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	148	90	30	19	9			25	7					29	2		9		1	51

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, 2017

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	91 (72.8)	35	49	7									7	7	56
Campylobacter coli	32 (25.6)	4	18	8	2			8	8	8	8		2	2	22
Campylobacter spp.	2 (1.6)			2									1	2	2
Total	**125 (100)**	**39**	**67**	**17**	**2**			**8**	**8**	**8**	**8**		**10**	**11**	**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.

Table 3. 12 Number of antimicrobial classes in resistance patterns of *Salmonella* from chickens, 2017

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	46 (36.2)	3	1	42			1	43	3	3	3	2								43
Enteritidis	29 (22.8)	29																		
Heidelberg	11 (8.7)	4	4	3			1	4	4	4	4	4		2	1		1			1
Typhimurium	10 (7.9)	3		6	1			1						7	2		2			7
Infantis	4 (3.1)	4																		
Thompson	4 (3.1)	4																		
Braenderup	3 (2.4)	2		1			1	1						1						
Cubana	3 (2.4)	3																		
Livingstone	3 (2.4)		3																	3
Senftenberg	3 (2.4)	3																		
Less common serovars	11 (8.7)	9	1	1				2						1						2
Total	**127 (100)**	**64**	**9**	**53**	**1**		**3**	**51**	**7**	**7**	**7**	**6**		**11**	**3**		**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, 2017

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	195	62	33	81	18	1	32	102	54	11	10	10		79	35	1	6	1	11	79

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, 2017

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	146 (86.9)	75	44	27				4	3	5	5		28	28	62
Campylobacter coli	21 (12.5)	10	5	5	1			1	1	1	1		10	10	6
Campylobacter spp.	1 (0.6)			1									1	1	1
Total	**168 (100)**	**85**	**49**	**33**	**1**			**5**	**4**	**6**	**6**		**39**	**39**	**69**

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, 2017

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	33 (18.9)	9	4	14	6			19	7	4	4	4		20	1					23
Infantis	23 (13.1)	22	1																	1
Typhimurium	19 (10.9)	1	2	5	9	2		14	15					16	6	2	10			16
London	15 (8.6)	13	2					1	1		1	1								1
Brandenburg	12 (6.9)	8	4					1	2	2	2	2		1	1					1
Bovismorbificans	9 (5.1)	9																		
4,[5],12:i:-	8 (4.6)			2	6			8	8					8	1		1			6
Schwarzengrund	7 (4.0)	4		3				3						3						3
4,12:-:-	5 (2.9)	5																		
Ohio	5 (2.9)	5																		
Kedougou	4 (2.3)	1	1	2				1						2	2					2
Livingstone	4 (2.3)		4																	4
Muenchen	4 (2.3)	2		2				2						2						2
Less common serovars	27 (15.4)	22	2	1	1	1	1	4	2	1	1	1		3	1	1	2			5
Total	**175 (100)**	**101**	**20**	**29**	**22**	**3**	**1**	**53**	**35**	**7**	**8**	**8**		**55**	**12**	**3**	**13**			**64**

The disparity between the total number of isolates reported in the temporal figure (n = 188) and multiclass resistance table (n = 187) is due to missing serotyping information.

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, 2017

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	164	32	35	78	19		2	72	63	1	2	1		54	16	1	13		1	114

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, 2017

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 (97.9)	58	77	46	50			66	70	85	85		19	19	153
Campylobacter spp.	3 (1.3)		2		1			1	1	1	1			3	1
Campylobacter jejuni	2 (0.8)		2												2
Total	**236 (100)**	**58**	**81**	**46**	**51**			**67**	**71**	**86**	**86**		**19**	**22**	**156**

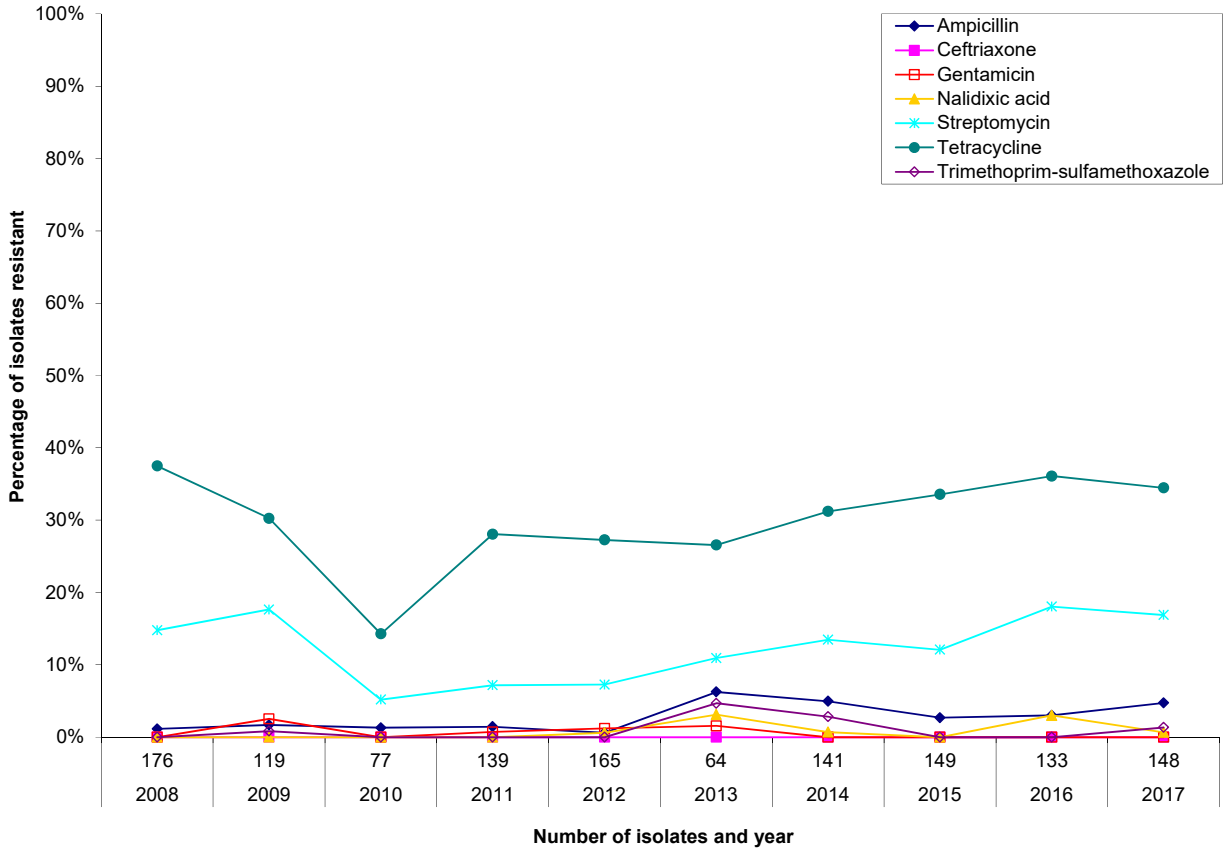
Antimicrobial abbreviations are defined in the Appendix.

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

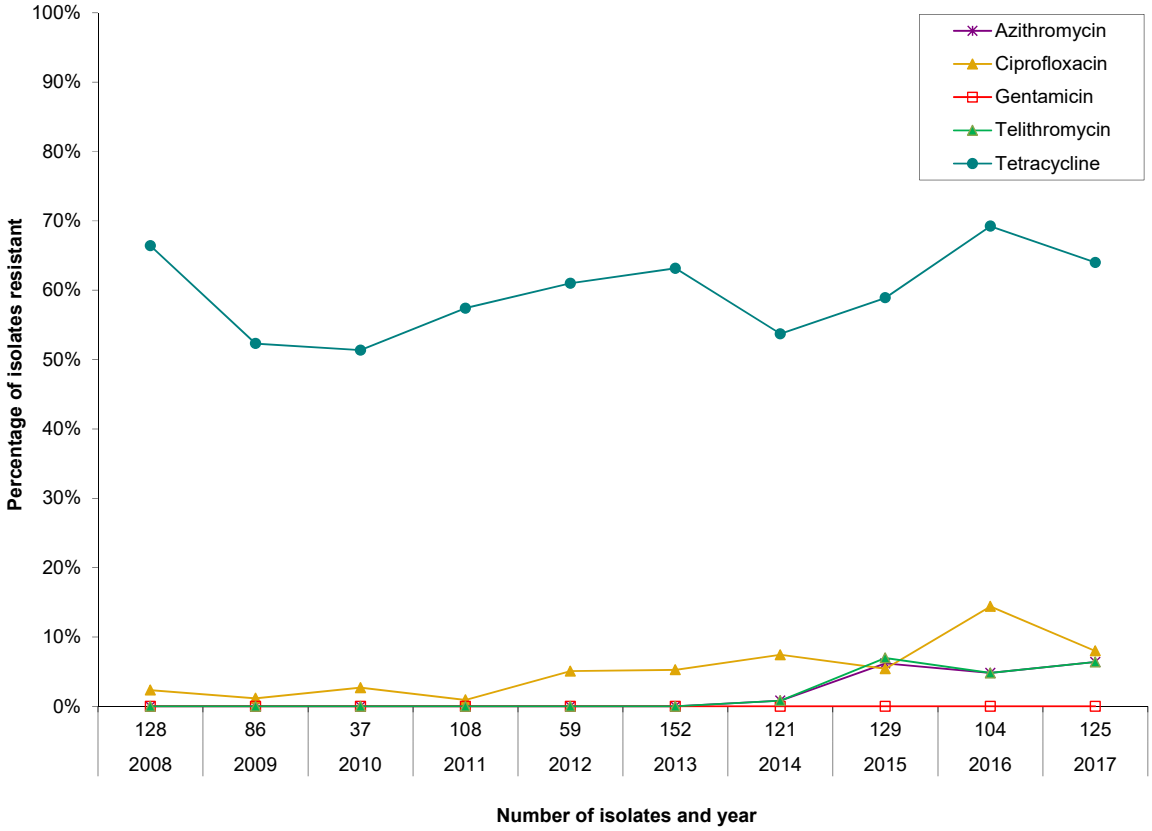
Figure 3. 18 Temporal variations in resistance of *Escherichia coli* isolates from beef cattle, 2008 to 2017



Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of isolates	176	119	77	139	165	64	141	149	133	148
Antimicrobial										
Ampicillin	**1%**	2%	1%	1%	1%	**6%**	5%	3%	**3%**	**5%**
Ceftriaxone	**0%**	0%	0%	0%	0%	**0%**	0%	0%	**0%**	**0%**
Gentamicin	**0%**	3%	0%	1%	1%	**2%**	0%	0%	**0%**	**0%**
Nalidixic acid	**0%**	0%	0%	0%	1%	**3%**	1%	0%	**3%**	**1%**
Streptomycin	**15%**	18%	5%	7%	7%	**11%**	13%	12%	**18%**	**17%**
Tetracycline	**38%**	30%	14%	28%	27%	**27%**	31%	34%	**36%**	**34%**
Trimethoprim-sulfamethoxazole	**0%**	1%	0%	0%	0%	**5%**	3%	0%	**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, 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.

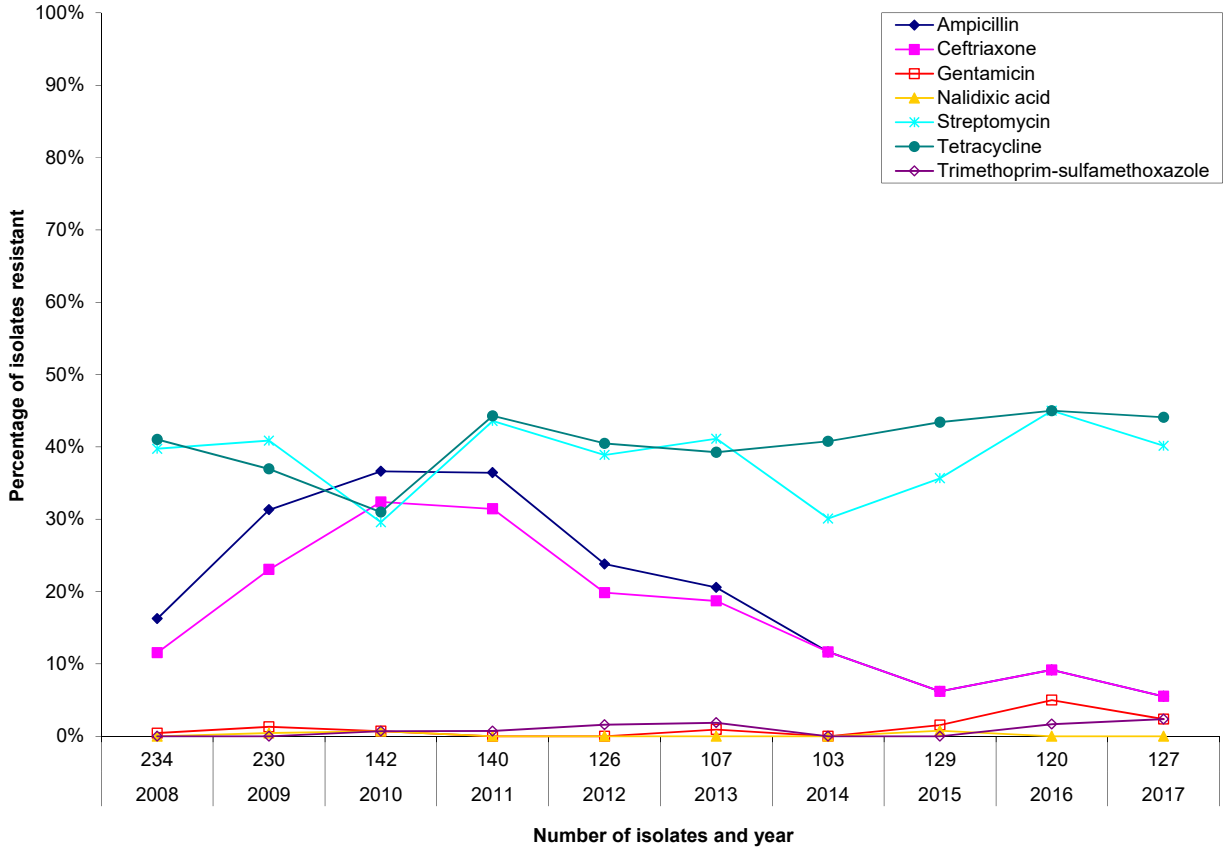
Figure 3. 19 Temporal variations in resistance of *Campylobacter* from beef cattle, 2008 to 2017



Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of isolates	128	86	37	108	59	152	121	129	104	125
Antimicrobial										
Azithromycin	**0%**	0%	0%	0%	0%	**0%**	1%	6%	**5%**	**6%**
Ciprofloxacin	**2%**	1%	3%	1%	5%	**5%**	7%	5%	**14%**	**8%**
Gentamicin	**0%**	0%	0%	0%	0%	**0%**	0%	0%	**0%**	**0%**
Telithromycin	**0%**	0%	0%	0%	0%	**0%**	1%	7%	**5%**	**6%**
Tetracycline	**66%**	52%	51%	57%	61%	**63%**	54%	59%	**69%**	**64%**

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.

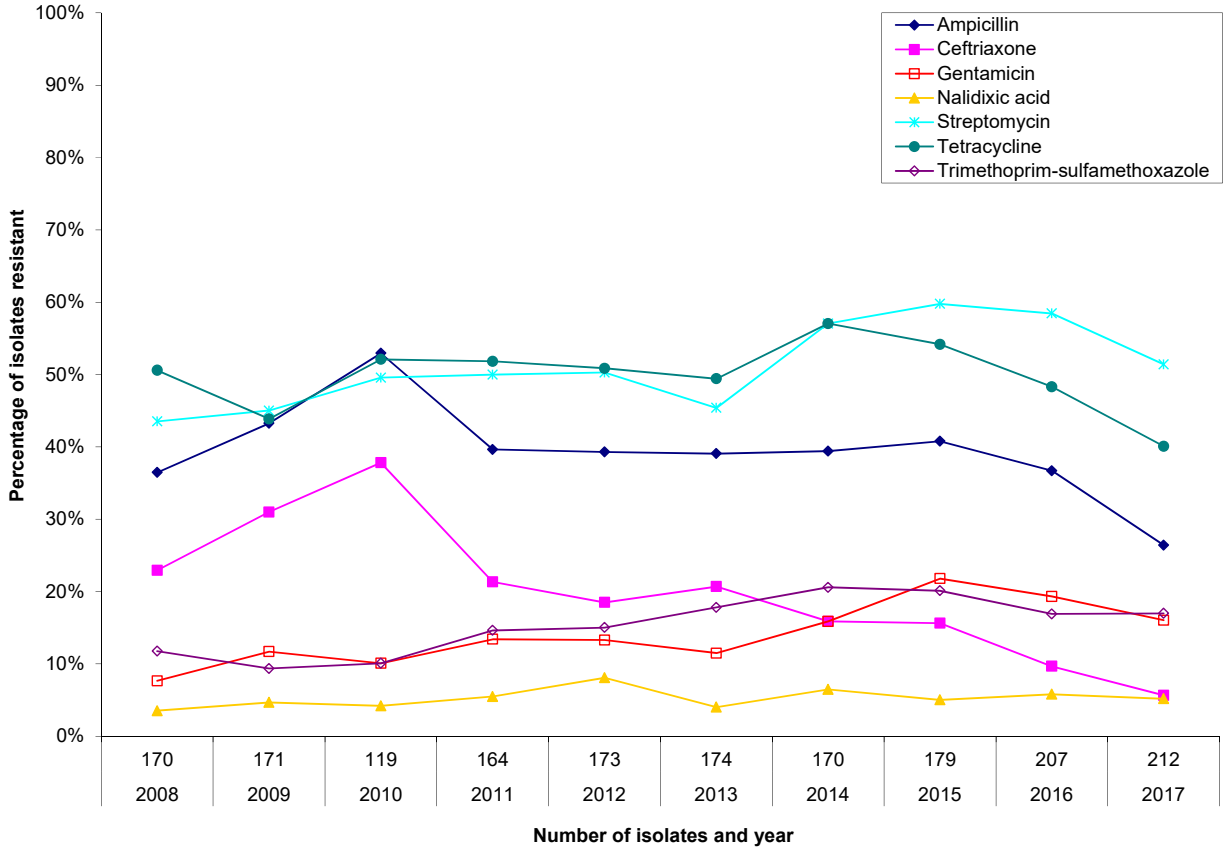
Figure 3. 20 Temporal variations in resistance of *Salmonella* isolates from chicken, 2008 to 2017



Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of isolates	234	230	142	140	126	107	103	129	120	127
Antimicrobial										
Ampicillin	**16%**	31%	37%	36%	24%	**21%**	12%	6%	**9%**	**6%**
Ceftriaxone	**12%**	23%	32%	31%	20%	**19%**	12%	6%	**9%**	**6%**
Gentamicin	**0%**	1%	1%	0%	0%	**1%**	0%	2%	**5%**	**2%**
Nalidixic acid	**0%**	0%	1%	0%	0%	**0%**	0%	1%	**0%**	**0%**
Streptomycin	**40%**	41%	30%	44%	39%	**41%**	30%	36%	**45%**	**40%**
Tetracycline	**41%**	37%	31%	44%	40%	**39%**	41%	43%	**45%**	**44%**
Trimethoprim-sulfamethoxazole	**0%**	0%	1%	1%	2%	**2%**	0%	0%	**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.

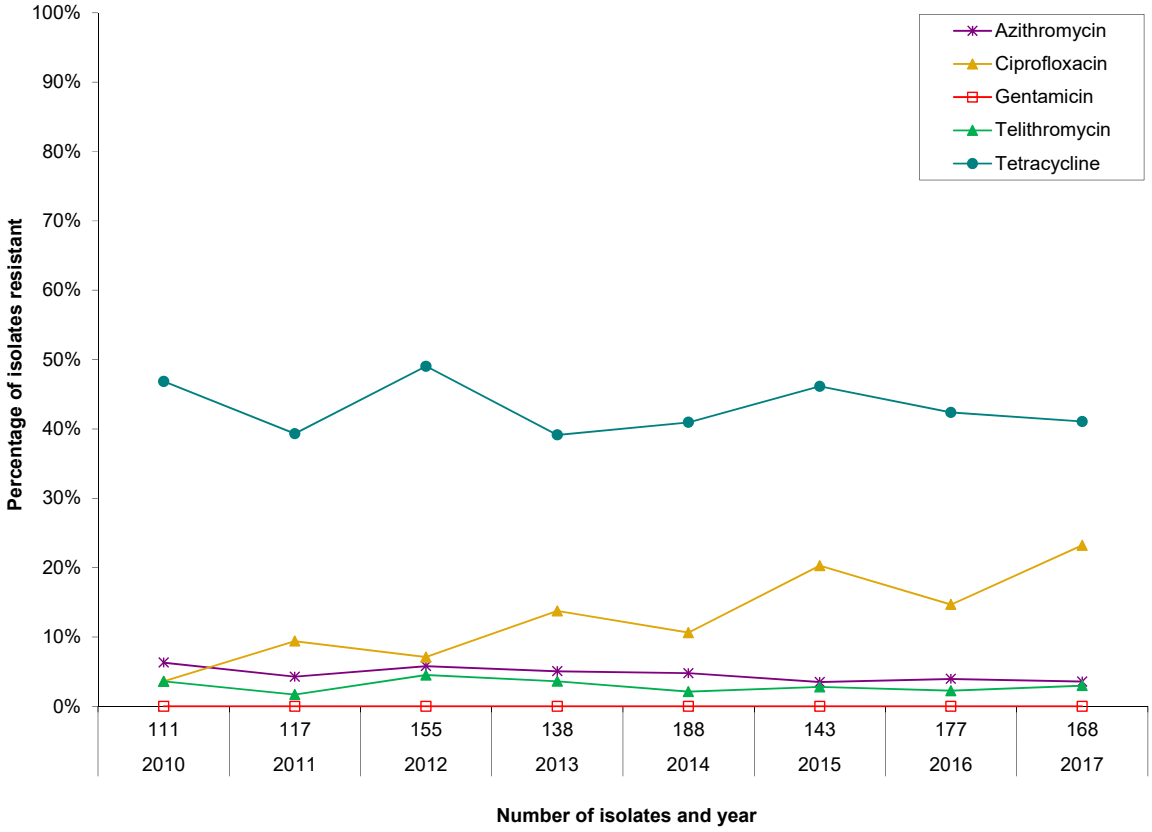
Figure 3. 21 Temporal variations in resistance of *Escherichia coli* isolates from chicken, 2008 to 2017



Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of isolates	170	171	119	164	173	174	170	179	207	212
Antimicrobial										
Ampicillin	**36%**	43%	53%	40%	39%	**39%**	39%	41%	**37%**	**26%**
Ceftriaxone	**23%**	31%	38%	21%	18%	**21%**	16%	16%	**10%**	**6%**
Gentamicin	**8%**	12%	10%	13%	13%	**11%**	16%	22%	**19%**	**16%**
Nalidixic acid	**4%**	5%	4%	5%	8%	**4%**	6%	5%	**6%**	**5%**
Streptomycin	**44%**	45%	50%	50%	50%	**45%**	57%	60%	**58%**	**51%**
Tetracycline	**51%**	44%	52%	52%	51%	**49%**	57%	54%	**48%**	**40%**
Trimethoprim-sulfamethoxazole	**12%**	9%	10%	15%	15%	**18%**	21%	20%	**17%**	**17%**

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.

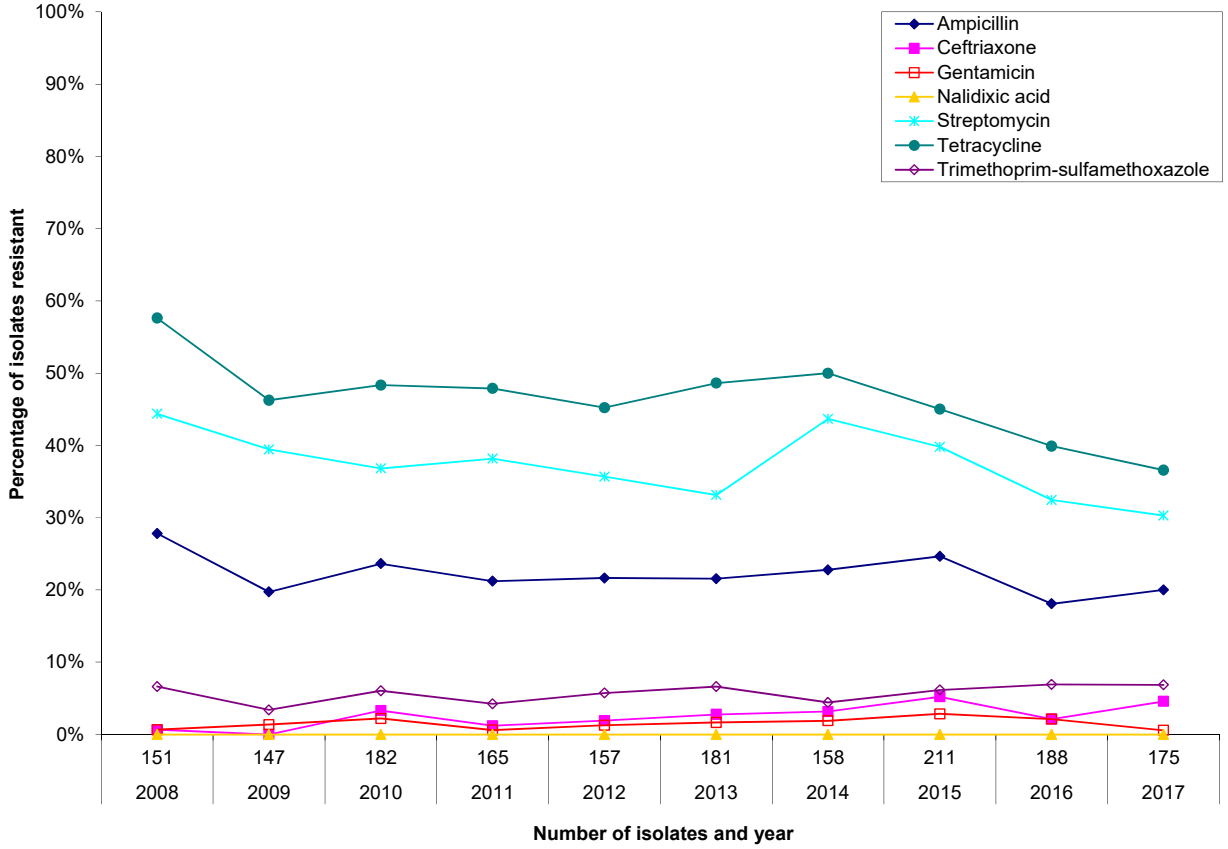
Figure 3. 22 Temporal variations in resistance of *Campylobacter* isolates from chickens, 2010 to 2017



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

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, 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.

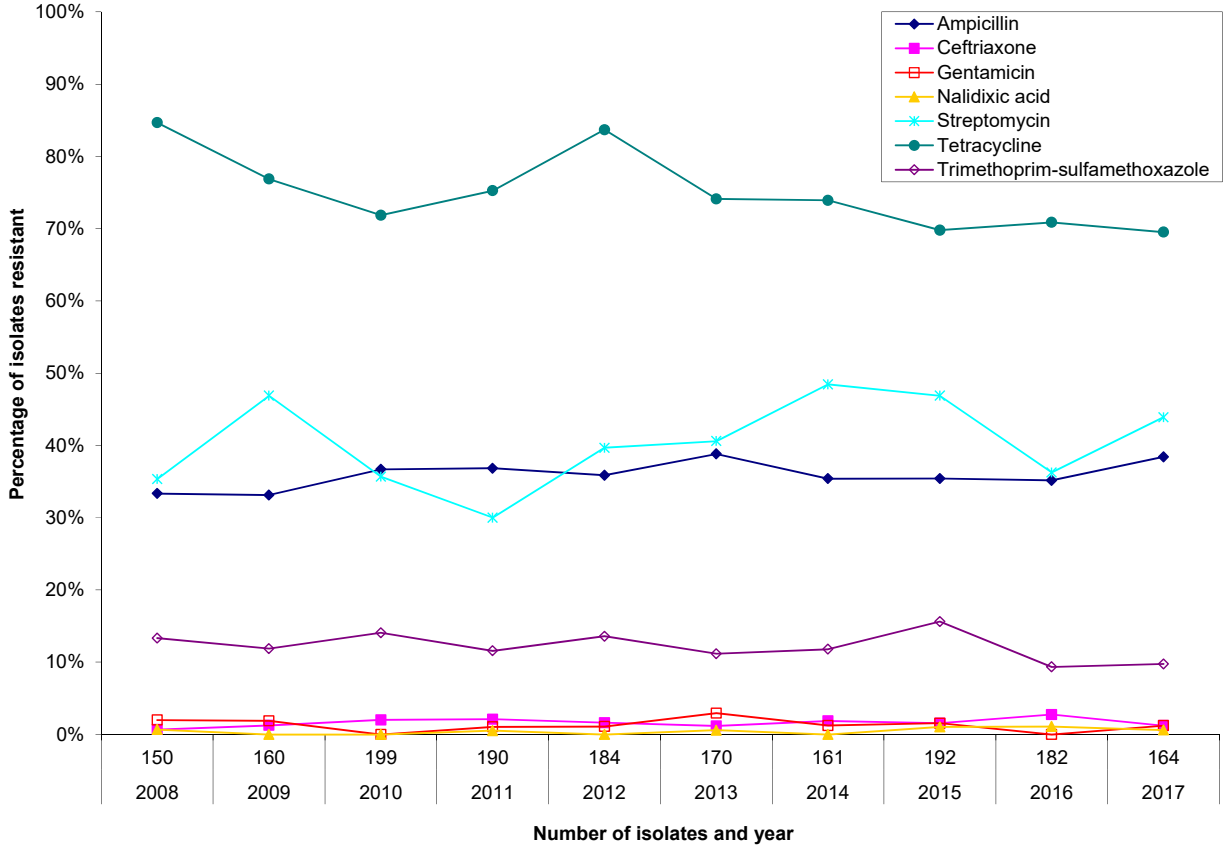
Figure 3. 23 Temporal variations in resistance of *Salmonella* isolates from pigs, 2008 to 2017



Year Number of isolates	2008 151	2009 147	2010 182	2011 165	2012 157	2013 181	2014 158	2015 211	2016 188	2017 175
Antimicrobial										
Ampicillin	**28%**	20%	24%	21%	22%	**22%**	23%	25%	**18%**	**20%**
Ceftriaxone	**1%**	0%	3%	1%	2%	**3%**	3%	5%	**2%**	**5%**
Gentamicin	**1%**	1%	2%	1%	1%	**2%**	2%	3%	**2%**	**1%**
Nalidixic acid	**0%**	0%	0%	0%	0%	**0%**	0%	0%	**0%**	**0%**
Streptomycin	**44%**	39%	37%	38%	36%	**33%**	44%	40%	**32%**	**30%**
Tetracycline	**58%**	46%	48%	48%	45%	**49%**	50%	45%	**40%**	**37%**
Trimethoprim-sulfamethoxazole	**7%**	3%	6%	4%	6%	**7%**	4%	6%	**7%**	**7%**

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.

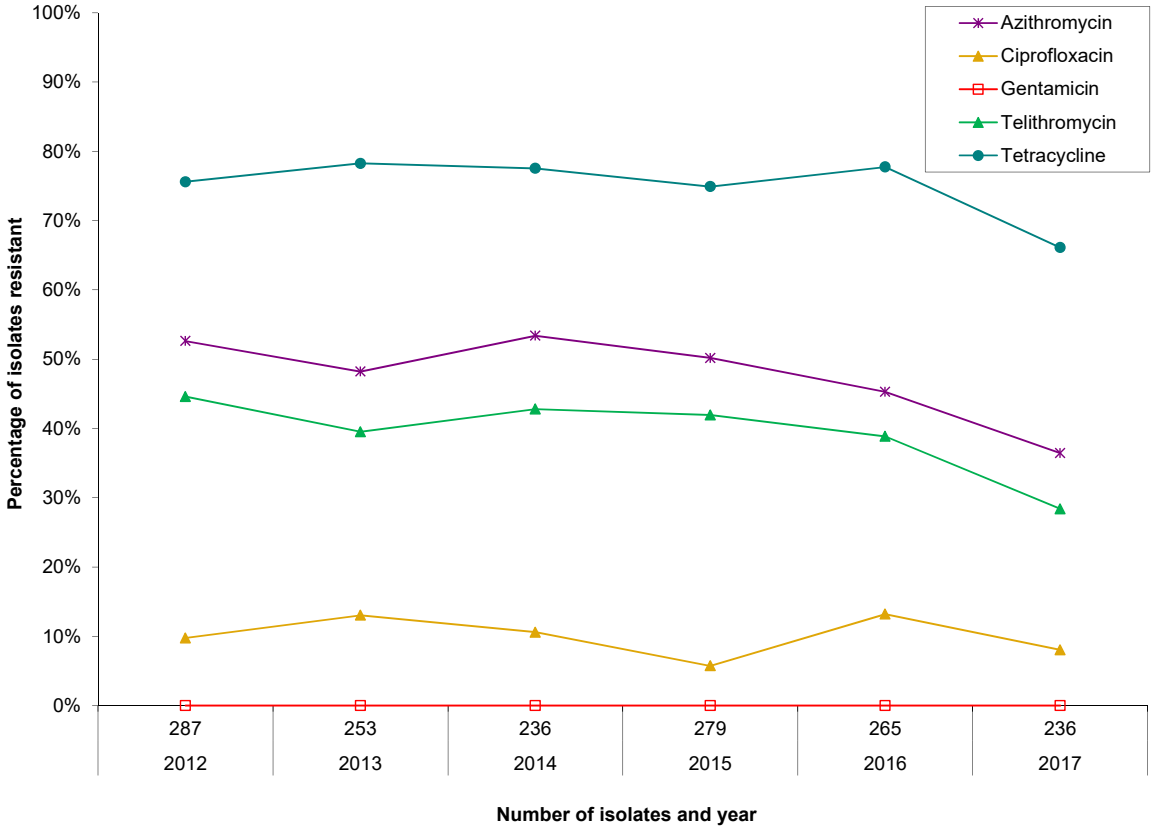
Figure 3. 24 Temporal variations in resistance of *Escherichia coli* isolates from pigs, 2008 to 2017



Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of isolates	150	160	199	190	184	170	161	192	182	164
Antimicrobial										
Ampicillin	**33%**	33%	37%	37%	36%	**39%**	35%	35%	**35%**	**38%**
Ceftriaxone	**1%**	1%	2%	2%	2%	**1%**	2%	2%	**3%**	**1%**
Gentamicin	**2%**	2%	0%	1%	1%	**3%**	1%	2%	**0%**	**1%**
Nalidixic acid	**1%**	0%	0%	1%	0%	**1%**	0%	1%	**1%**	**1%**
Streptomycin	**35%**	47%	36%	30%	40%	**41%**	48%	47%	**36%**	**44%**
Tetracycline	**85%**	77%	72%	75%	84%	**74%**	74%	70%	**71%**	**70%**
Trimethoprim-sulfamethoxazole	**13%**	12%	14%	12%	14%	**11%**	12%	16%	**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, 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 2017



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

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.

Recovery results

Table 3. 18 Abattoir Surveillance recovery rates, 2002 to 2017

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	
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	

See corresponding footnotes at the end of the table.

Table 3. 18 Abattoir Surveillance recovery rates, 2002 to 2017 (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		

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 beef, 2017

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
Feedlot Beef	75 (100)	34	21	17	3			15	3					12	1		3		2	41

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 beef, 2017

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	29 (67.4)	5	24												24
Campylobacter jejuni	14 (32.6)	2	12												12
Total	**43 (100)**	**7**	**36**												**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.

Table 3. 21 Number of antimicrobial classes in resistance patterns of *Salmonella* from chicks and barn environment at placement, 2017

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	20 (95.2)	20																		
8,20:-:z6	1 (4.8)			1				1	1	1	1	1								1
Total	**21 (100)**	**20**		**1**				**1**	**1**	**1**	**1**	**1**								**1**
Prairies																				
Enteritidis	9 (75.0)	9																		
Kentucky	2 (16.7)			2				2												2
Typhimurium	1 (8.3)				1			1	1					1			1			1
Total	**12 (100)**	**9**		**2**	**1**			**3**	**1**					**1**			**1**			**3**
Ontario																				
Enteritidis	3 (50.0)	3																		
Mbandaka	3 (50.0)	3																		
Total	**6 (100)**	**6**																		
Québec																				
Kentucky	9 (60.0)			9				9												9
Enteritidis	5 (33.3)	5																		
Braenderup	1 (6.7)	1																		
Total	**15 (100)**	**6**		**9**				**9**												**9**
National																				
Enteritidis	37 (68.5)	37																		
Kentucky	11 (20.4)			11				11												11
Mbandaka	3 (5.6)	3																		
Braenderup	1 (1.9)	1																		
8,20:-:z6	1 (1.9)			1				1	1	1	1	1								1
Typhimurium	1 (1.9)				1			1	1					1			1			1
Total	**54 (100)**	**41**		**12**	**1**			**13**	**2**	**1**	**1**	**1**		**1**			**1**			**13**

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 *Salmonella* from chickens pre-harvest, 2017

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	24 (36.9)		3	21				21	7	7	7	7								21
Enteritidis	22 (33.8)	22																		
Infantis	6 (9.2)	2		4			3	4						4						4
Mbandaka	5 (7.7)	4	1					1												
Senftenberg	4 (6.2)	4																		
Amager	2 (3.1)	2																		
Less common serovars	2 (3.1)	2																		
Total	**65 (100)**	**36**	**4**	**25**			**3**	**26**	**7**	**7**	**7**	**7**		**4**						**25**
Prairies																				
Enteritidis	35 (48.0)	35																		
Kentucky	16 (21.9)			16				16												16
Braenderup	5 (6.9)	4	1						1	1	1	1								
Mbandaka	5 (6.9)	5																		
Infantis	4 (5.5)	4																		
Less common serovars	8 (11.0)	7			1			1						1			1			1
Total	**73 (100)**	**55**	**1**	**16**	**1**			**17**	**1**	**1**	**1**	**1**		**1**			**1**			**17**
Ontario																				
Kentucky	21 (41.2)	1		20				20												20
Mbandaka	7 (13.7)	7																		
Enteritidis	4 (7.8)	4																		
Liverpool	4 (7.8)	2	2																	2
Muenchen	4 (7.8)	4																		
Braenderup	3 (5.8)	3																		
Heidelberg	2 (3.9)	2																		
Indiana	2 (3.9)	2																		
Livingstone	2 (3.9)		2																	2
Typhimurium	2 (3.9)			2										2						2
Total	**51 (100)**	**25**	**4**	**22**				**20**						**2**						**26**
Québec																				
Kentucky	36 (48.7)	4	1	31				32	3	3	3	3								31
Schwarzengrund	10 (13.5)			10				10						10						10
Enteritidis	8 (10.8)	8																		
Rough:i:z6	5 (6.8)			5				5	1	1	1	1								5
Braenderup	4 (5.4)	4																		
Hadar	4 (5.4)			4				4												4
Thompson	3 (4.1)	3																		
Infantis	2 (2.7)	2																		
Less common serovars	2 (2.7)	1		1				1												1
Total	**74 (100)**	**22**	**1**	**51**				**52**	**4**	**4**	**4**	**4**		**10**						**51**
National																				
Kentucky	97 (36.9)	5	4	88				89	10	10	10	10								88
Enteritidis	69 (26.2)	69																		
Mbandaka	17 (6.5)	16	1					1												
Braenderup	12 (4.6)	11	1						1	1	1	1								
Infantis	12 (4.6)	8		4			3	4						4						4
Schwarzengrund	10 (3.8)			10				10						10						10
Less common serovars	46 (17.5)	29	4	12	1			11	1	1	1	1		3			1			17
Total	**263 (100)**	**138**	**10**	**114**	**1**		**3**	**115**	**12**	**12**	**12**	**12**		**17**			**1**			**119**

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. 23 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from chicks and barn environment at placement, 2017

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
Chick pads																				
British Columbia	38 (23.6)	11	4	12	11		12	17	15	3	5	3		14	2		1	1	6	24
Prairies	33 (20.5)	9	9	13	2		9	13	6	2	2	2		9	1			1	2	17
Ontario	44 (27.3)	13	8	16	7		17	20	12	8	9	8		15	1		3			25
Québec	46 (28.6)	16	5	13	12		19	22	19	7	7	7		21	2		2	1	1	23
National	**161 (100)**	**49**	**26**	**54**	**32**		**57**	**72**	**52**	**20**	**23**	**20**		**59**	**6**		**6**	**3**	**9**	**89**
Environment																				
British Columbia	21 (27.6)	4		10	7		7	15	11	4	4	4		11	3		1		2	13
Prairies	15 (19.7)	7	1	4	3		2	5	2					5	1		2		1	7
Ontario	21 (27.6)	3	5	12	1		2	6	12	3	5	3		4	1				1	14
Québec	19 (25.0)	4	2	7	5	1	3	11	10	1	1	1		12	7	1	3	1	1	11
National	**76 (100)**	**18**	**8**	**33**	**16**	**1**	**14**	**37**	**35**	**8**	**10**	**8**		**32**	**12**	**1**	**6**	**1**	**5**	**45**
Placement																				
British Columbia	59 (24.9)	15	4	22	18		19	32	26	7	9	7		25	5		2	1	8	37
Prairies	48 (20.2)	16	10	17	5		11	18	8	2	2	2		14	2		2	1	3	24
Ontario	65 (27.4)	16	13	28	8		19	26	24	11	14	11		19	2		3		1	39
Québec	65 (27.4)	20	7	20	17	1	22	33	29	8	8	8		33	9	1	5	2	2	34
National	**237 (100)**	**67**	**34**	**87**	**48**	**1**	**71**	**109**	**87**	**28**	**33**	**28**		**91**	**18**	**1**	**12**	**4**	**14**	**134**

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 *Escherichia coli* from chickens at pre-harvest, 2017

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	117 (21.7)	25	21	40	31		25	60	67	25	25	24		52	13		8	2	14	48
Prairies	152 (28.2)	61	23	51	17		21	64	38	6	6	9		40	11		3	1	6	58
Ontario	154 (28.6)	52	37	42	23		18	54	51	8	9	8		50	27		6		6	74
Québec	116 (21.5)	12	4	74	26		42	92	50	15	13	15		76	42		10		3	78
National	**539 (100)**	**150**	**85**	**207**	**97**		**106**	**270**	**206**	**54**	**53**	**56**		**218**	**93**		**27**	**3**	**29**	**258**

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. 25 Number of antimicrobial classes in resistance patterns of *Campylobacter* from chickens at pre-harvest, 2017

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	4 (9.1)		4										4	4	
Campylobacter jejuni	40 (90.9)	23	5	12									12	12	17
Total	**44 (100)**	**23**	**9**	**12**									**16**	**16**	**17**
Prairies															
Campylobacter jejuni	30 (100)	21	9												9
Total	**30 (100)**	**21**	**9**												**9**
Ontario															
Campylobacter jejuni	36 (100)	17	14	5									5	5	19
Total	**36 (100)**	**17**	**14**	**5**									**5**	**5**	**19**
Québec															
Campylobacter jejuni	12 (100)	4	5	3				3	1	4	4				4
Total	**12 (100)**	**4**	**5**	**3**				**3**	**1**	**4**	**4**				**4**
National															
Campylobacter coli	4 (3.3)		4										4	4	
Campylobacter jejuni	118 (96.7)	65	33	20				3	1	4	4		17	17	49
Total	**122 (100)**	**65**	**37**	**20**				**3**	**1**	**4**	**4**		**21**	**21**	**49**

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. 26 Number of antimicrobial classes in resistance patterns of *Salmonella* from pigs, 2017

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																				
Infantis	13 (28.3)	7			6			6	6					6						6
Brandenburg	9 (19.6)	4	4	1				1												5
Typhimurium	7 (15.2)	1			6			6	6					6			6			6
Derby	4 (8.7)			2	2			4	2					4						4
Bovismorbificans	2 (4.4)	1	1					1												
Enteritidis	2 (4.4)	2																		
Worthington	2 (4.4)	1		1				1	1	1	1	1		1	1					
Agona	1 (2.2)	1																		
4,[5],12:i:-	1 (2.2)				1			1	1					1						1
Mbandaka	1 (2.2)	1																		
Mbandaka var. 14+	1 (2.2)			1			1	1												1
Ohio	1 (2.2)			1				1						1						1
Putten	1 (2.2)	1																		
Schwarzengrund	1 (2.2)			1				1						1						1
Total	**46 (100)**	**19**	**5**	**7**	**15**		**1**	**23**	**16**	**1**	**1**	**1**		**20**	**1**		**6**			**25**
Ontario																				
Typhimurium	9 (34.6)			5	4		1	7	6					9	1		4			9
4,[5],12:i:-	4 (15.4)			1	3			4	4					4						3
Infantis	4 (15.4)	4																		
Derby	3 (11.5)			1	2			3	2	1	1	1		3						3
Enteritidis	3 (11.5)	3																		
Anatum	1 (3.9)	1																		
Kedougou	1 (3.9)			1										1	1					1
Rissen	1 (3.9)				1			1	1					1	1		1			1
Total	**26 (100)**	**8**		**8**	**10**		**1**	**15**	**13**	**1**	**1**	**1**		**18**	**3**		**5**			**17**
Québec																				
Typhimurium	29 (64.4)		1	6	22		3	24	20					24	10	8	14			28
Alachua	6 (13.3)	6																		
Ohio	3 (6.7)	1			2			2	2					2			2			2
Agona	2 (4.4)				2			2	2	2	2	2		2						2
4,[5],12:i:-	2 (4.4)				2			2	2					2			1			2
Infantis	2 (4.4)	2																		
Brandenburg	1 (2.2)	1																		
Total	**45 (100)**	**10**	**1**	**6**	**28**		**3**	**30**	**26**	**2**	**2**	**2**		**30**	**10**	**8**	**17**			**34**
National																				
Typhimurium	45 (38.5)	1	1	11	32		4	37	32					39	11	8	24			43
Infantis	19 (16.2)	13			6			6	6					6						6
Brandenburg	10 (8.6)	5	4	1				1												5
Derby	7 (6.0)			3	4			7	4	1	1	1		7						7
4,[5],12:i:-	7 (6.0)			1	6			7	7					7			1			6
Alachua	6 (5.1)	6																		
Enteritidis	5 (4.3)	5																		
Ohio	4 (3.4)	1		1	2			3	2					3			2			3
Agona	3 (2.6)	1			2			2	2	2	2	2		2						2
Less common serovars	11 (9.4)	5	1	4	1		1	5	2	1	1	1		4	3		1			4
Total	**117 (100)**	**37**	**6**	**21**	**53**		**5**	**68**	**55**	**4**	**4**	**4**		**68**	**14**	**8**	**28**			**76**

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. 27 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from pigs, 2017

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	227 (46.9)	80	50	75	22			75	57	1	1	1		57	21		21			114
Ontario	138 (28.5)	17	24	68	29		2	62	49	1	1	1		62	20	2	25		1	120
Québec	119 (24.6)	13	22	56	28		6	69	32					66	32		30			100
National	**484 (100.0)**	**110**	**96**	**199**	**79**		**8**	**206**	**138**	**2**	**2**	**2**		**185**	**73**	**2**	**76**		**1**	**334**

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. 28 Number of antimicrobial classes in resistance patterns of *Campylobacter* from pigs, 2017

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	184 (98.4)	60	44	39	41			62	66	77	77		10	10	95
Campylobacter spp.	3 (1.6)	1		1	1				1	1	1			2	2
Total	**187 (100)**	**61**	**44**	**40**	**42**			**62**	**67**	**78**	**78**		**10**	**12**	**97**
Ontario															
Campylobacter coli	97 (99.0)	13	22	14	48			51	54	58	58		6	6	80
Campylobacter spp.	1 (1.0)				1			1	1	1	1			1	1
Total	**98 (100)**	**13**	**22**	**14**	**49**			**52**	**55**	**59**	**59**		**6**	**7**	**81**
Québec															
Campylobacter coli	84 (100)	8	38	23	15			21	22	24	24		14	14	72
Total	**84 (100)**	**8**	**38**	**23**	**15**			**21**	**22**	**24**	**24**		**14**	**14**	**72**
National															
Campylobacter coli	365 (99.9)	81	104	76	104			134	142	159	159		30	30	247
Campylobacter spp.	4 (1.1)	1		1	2			1	2	2	2			3	3
Total	**369 (100)**	**82**	**104**	**77**	**106**			**135**	**144**	**161**	**161**		**30**	**33**	**250**

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. 29 Number of antimicrobial classes in resistance patterns of *Salmonella* from turkeys, 2017

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																				
Hadar	15 (31.9)		1	14				14	10											14
Senftenberg	8 (17.0)	3	2	3			5	5	3											
Albany	7 (14.9)		5	2			7	2												2
Agona	5 (10.6)			4	1		5	5	1					5						5
Anatum	4 (8.5)	1		3			1	3	2											3
Reading	4 (8.5)	4																		
Montevideo	2 (4.3)		2					2												
Liverpool	1 (2.1)			1				1						1						1
Uganda	1 (2.1)	1																		
Total	**47 (100)**	**9**	**10**	**27**	**1**		**18**	**32**	**16**					**6**						**25**
Ontario																				
Muenchen	27 (35.5)	22	3	2			3	2						2						2
Uganda	26 (31.3)			26				26						26						26
Senftenberg	7 (8.4)	1		6			6	4	6											
Bredeney	5 (6.0)		5				5													
Montevideo	5 (6.0)	4	1				1	1												
Heidelberg	4 (4.8)	3		1			1	1	1											1
Typhimurium	4 (4.8)			4										4						4
Derby	3 (3.6)			3			3	3	3											3
Less common serovars	2 (2.4)		1	1			1	2						1						1
Total	**83 (100)**	**30**	**10**	**43**			**20**	**39**	**10**					**33**						**37**
Québec																				
Agona	8 (26.8)	5		3			2	3						2						1
Heidelberg	7 (22.6)	3		4			4	4						4						
Schwarzengrund	7 (22.6)	2		5				5						5						5
Saintpaul	3 (9.7)	3																		
Uganda	3 (9.7)			3				3						3						3
4,12:-:1,2	1 (3.2)	1																		
Senftenberg	1 (3.2)				1			1						1	1		1			1
Worthington	1 (3.2)		1																	1
Total	**31 (100)**	**14**	**1**	**15**	**1**		**6**	**16**						**15**	**1**		**1**			**11**
National																				
Uganda	30 (18.6)	1		29				29						29						29
Muenchen	27 (16.8)	22	3	2			3	2						2						2
Senftenberg	16 (9.9)	4	2	9	1		11	10	9					1	1		1			1
Hadar	15 (9.3)		1	14				14	10											14
Agona	13 (8.1)	5		7	1		7	8	1					7						6
Heidelberg	11 (6.8)	6		5			5	5	1					4						1
Albany	8 (5.0)		6	2			8	3												2
Montevideo	7 (4.4)	4	3				1	3												
Schwarzengrund	7 (4.4)	2		5				5						5						5
Bredeney	5 (3.1)		5				5													
Anatum	4 (2.5)	1		3			1	3	2											3
Reading	4 (2.5)	4																		
Typhimurium	4 (2.5)			4										4						4
Derby	3 (1.9)			3			3	3	3											3
Saintpaul	3 (1.9)	3																		
Less common serovars	4 (2.5)	1	1	2				2						2						3
Total	**161 (100)**	**53**	**21**	**85**	**2**		**44**	**87**	**26**					**54**	**1**		**1**			**73**

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. 30 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from turkeys, 2017

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	106	22	11	46	27		29	69	45	2	1	2		44	5	1	6		4	66
Ontario	120	34	17	49	20		29	56	41	1		1		32	6		5		2	79
Québec	61	17	11	27	6		10	22	21	1	1	1		27	15		1			35
National	**287**	**73**	**39**	**122**	**53**		**68**	**147**	**107**	**4**	**2**	**4**		**103**	**26**	**1**	**12**		**6**	**180**

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. 31 Number of antimicrobial classes in resistance patterns of *Campylobacter* from turkeys, 2017

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	23 (28.8)		10	13						1	1		20	20	15
Campylobacter jejuni	56 (70.0)	23	16	17									20	20	30
Campylobacter spp.	1 (1.3)		1										1	1	
Total	**80 (100)**	**23**	**27**	**30**						**1**	**1**		**41**	**41**	**45**
Ontario															
Campylobacter coli	25 (50.0)	15	2	6	2			2	4	8	8		6	5	8
Campylobacter jejuni	25 (50.0)	5	20												20
Total	**50 (100)**	**20**	**22**	**6**	**2**			**2**	**4**	**8**	**8**		**6**	**5**	**28**
Québec															
Campylobacter coli	10 (37.0)			10					10	10	10				
Campylobacter jejuni	17 (63.0)	10	3	4					4	4	4				6
Total	**27 (100)**	**10**	**3**	**14**					**14**	**14**	**14**				**6**
National															
Campylobacter coli	58 (36.9)	15	12	29	2			2	14	19	19		26	25	23
Campylobacter jejuni	98 (62.4)	38	39	21					4	4	4		20	20	56
Campylobacter spp.	1 (0.6)		1										1	1	
Total	**157 (100)**	**53**	**52**	**50**	**2**			**2**	**18**	**23**	**23**		**47**	**46**	**79**

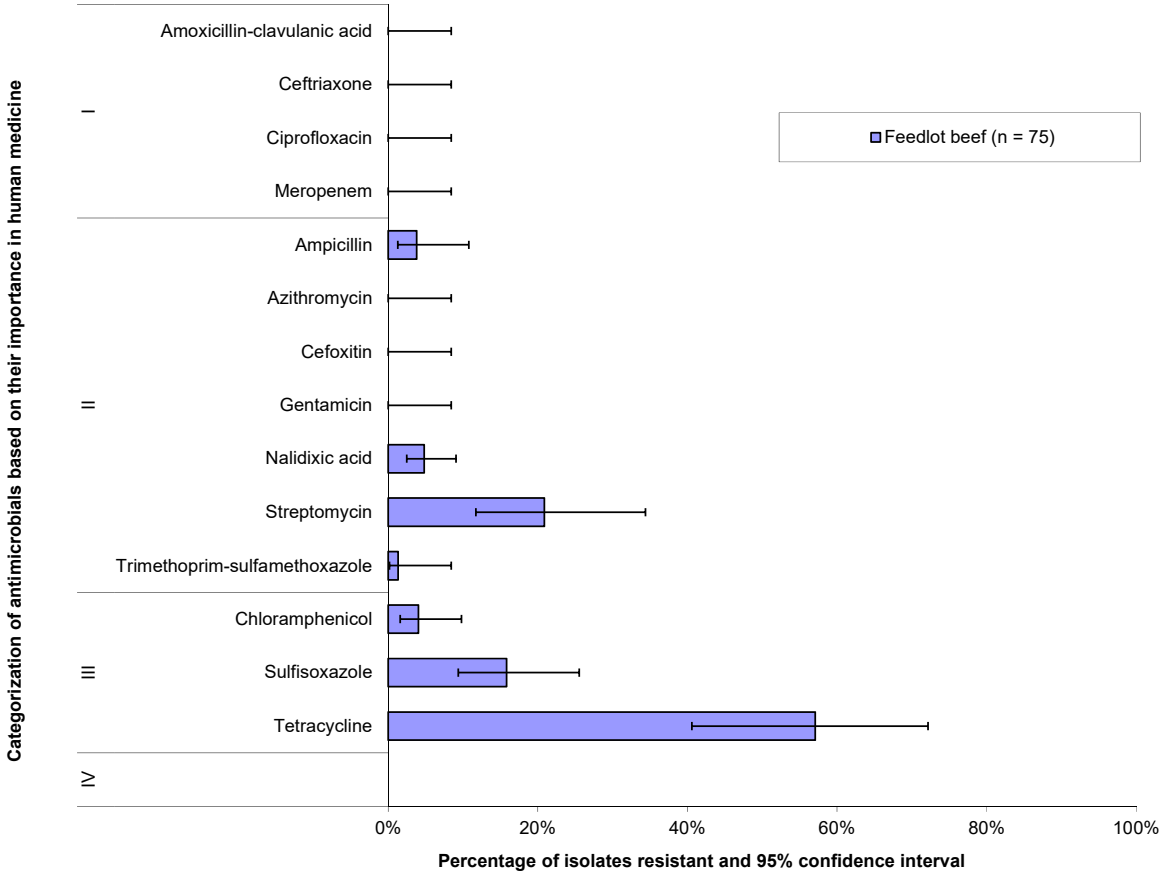
Antimicrobial abbreviations are defined in the Appendix.

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.

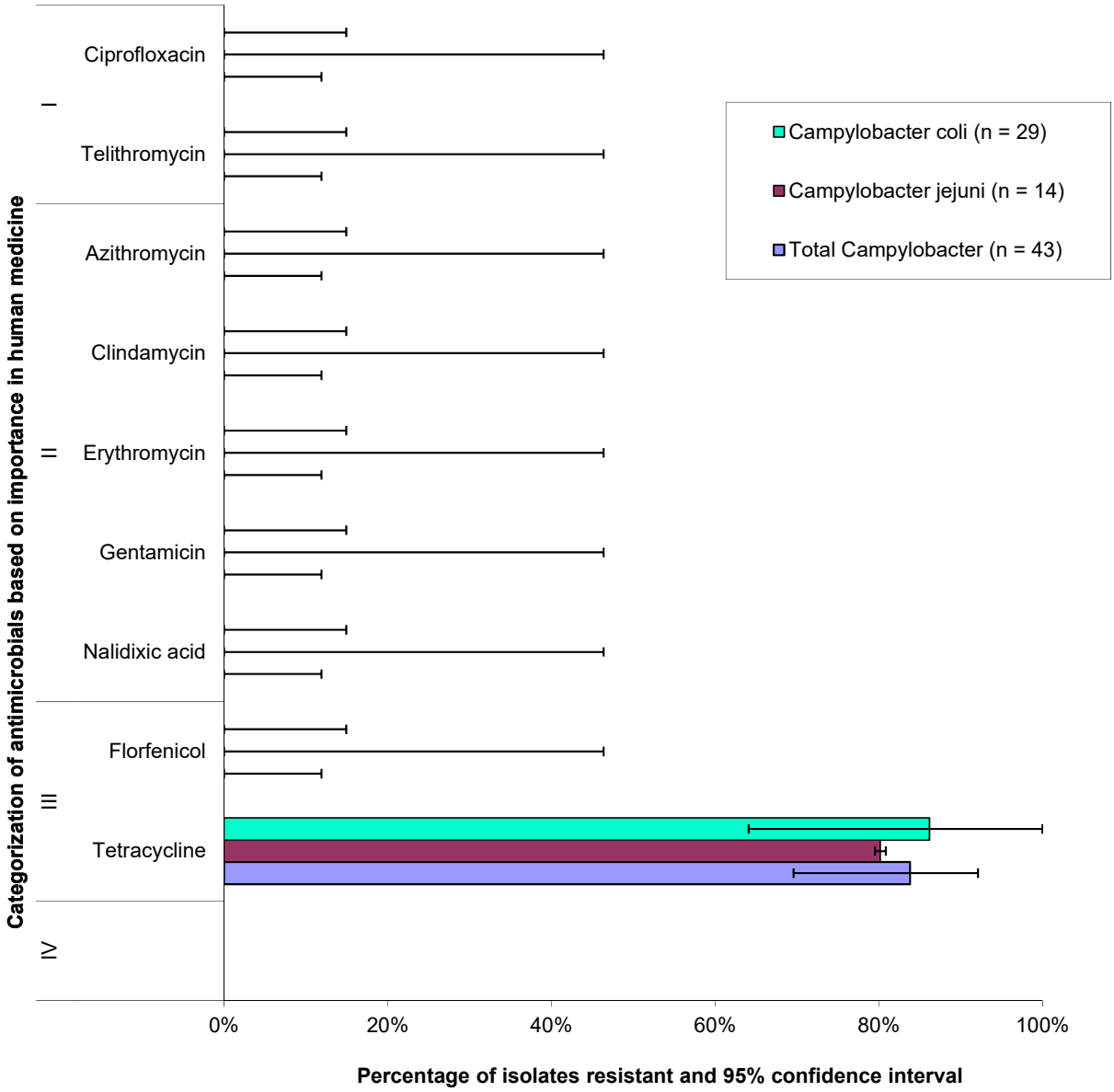
Temporal antimicrobial resistance summary

Figure 3. 26 Resistance of *Escherichia coli* isolates from feedlot beef cattle, 2017



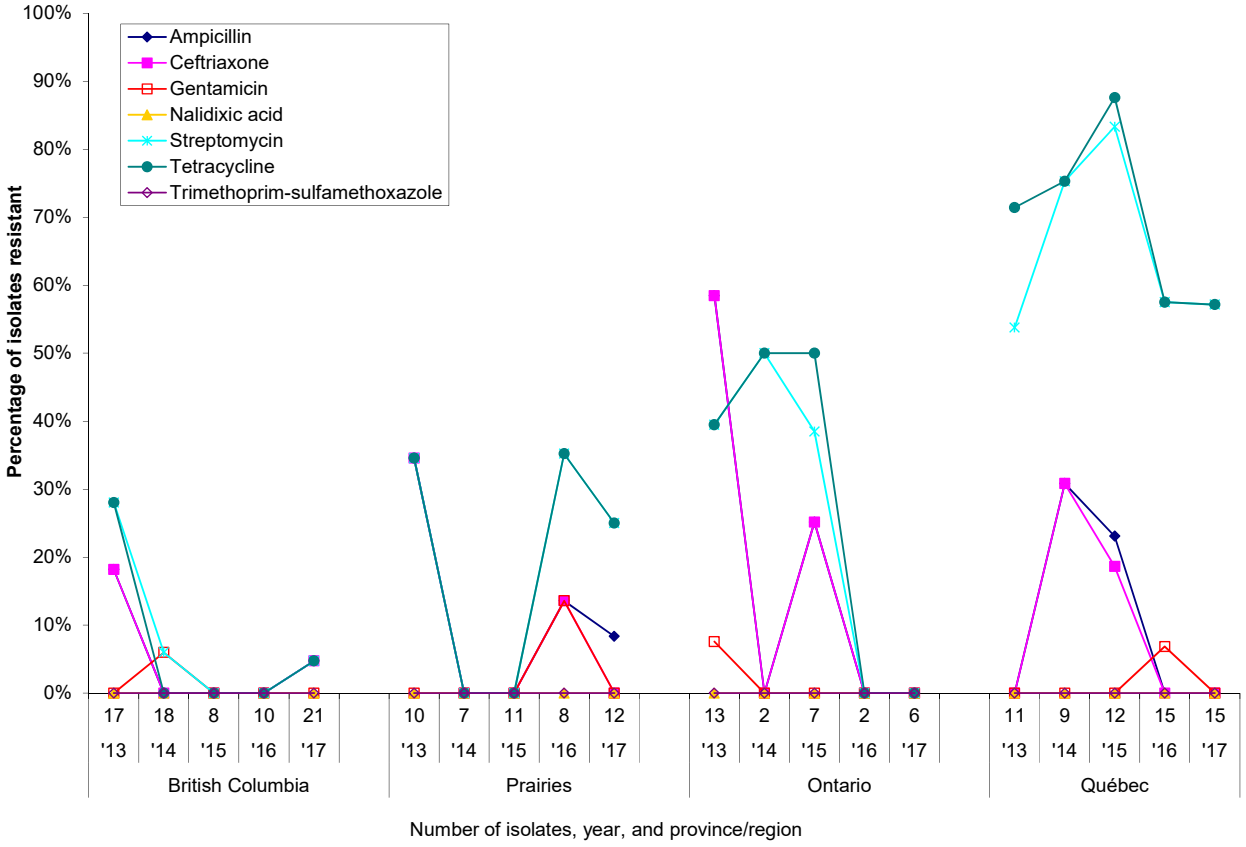
The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per feedlot.

Figure 3. 27 Resistance of *Campylobacter* isolates from feedlot beef cattle, 2017



This figure summarizes the proportion (%, adjusted to account for multiple samples per herd) of isolates resistant to a specific antimicrobial for the 2017 sampling year.

Figure 3. 28 Temporal variations in resistance of *Salmonella* isolates from chicks and barn environment at placement, 2013 to 2017



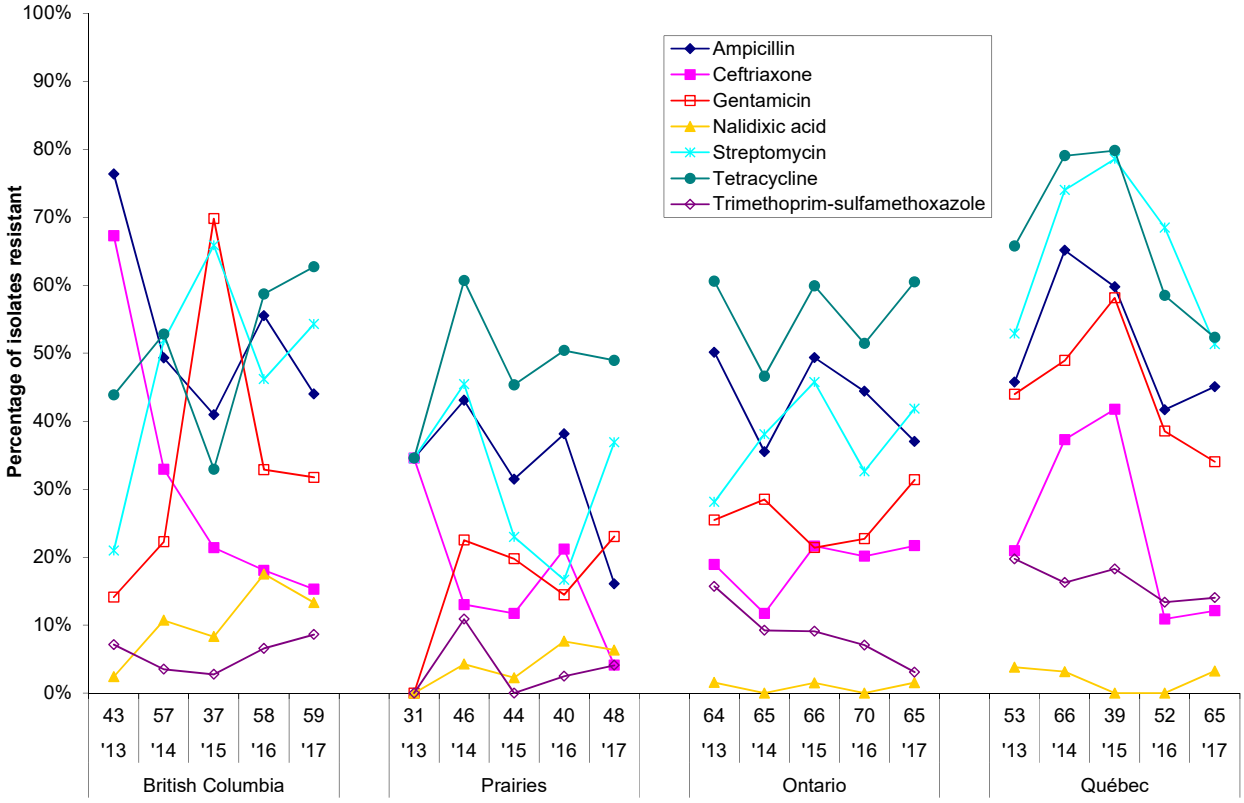
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	17	18	8	10	21	10	7	11	8	12	13	2	7	2	6	11	9	12	15	15
Antimicrobial																				
Ampicillin	**18%**	0%	0%	**0%**	**5%**	**35%**	0%	0%	**14%**	**8%**	**58%**	0%	25%	**0%**	**0%**	**0%**	31%	23%	**0%**	**0%**
Ceftriaxone	**18%**	0%	0%	**0%**	**5%**	**35%**	0%	0%	**14%**	**0%**	**58%**	0%	25%	**0%**	**0%**	**0%**	31%	19%	**0%**	**0%**
Gentamicin	**0%**	6%	0%	**0%**	**0%**	**0%**	0%	0%	**14%**	**0%**	**8%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**7%**	**0%**
Nalidixic acid	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
Streptomycin	**28%**	6%	0%	**0%**	**5%**	**35%**	0%	0%	**35%**	**25%**	**39%**	50%	38%	**0%**	**0%**	**54%**	75%	83%	**58%**	**57%**
Tetracycline	**28%**	0%	0%	**0%**	**5%**	**35%**	0%	0%	**35%**	**25%**	**39%**	50%	50%	**0%**	**0%**	**71%**	75%	88%	**58%**	**57%**
Trimethoprim-sulfamethoxazole	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

For the temporal analyses by 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 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/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 chicks and barn environment at placement, 2013 to 2017



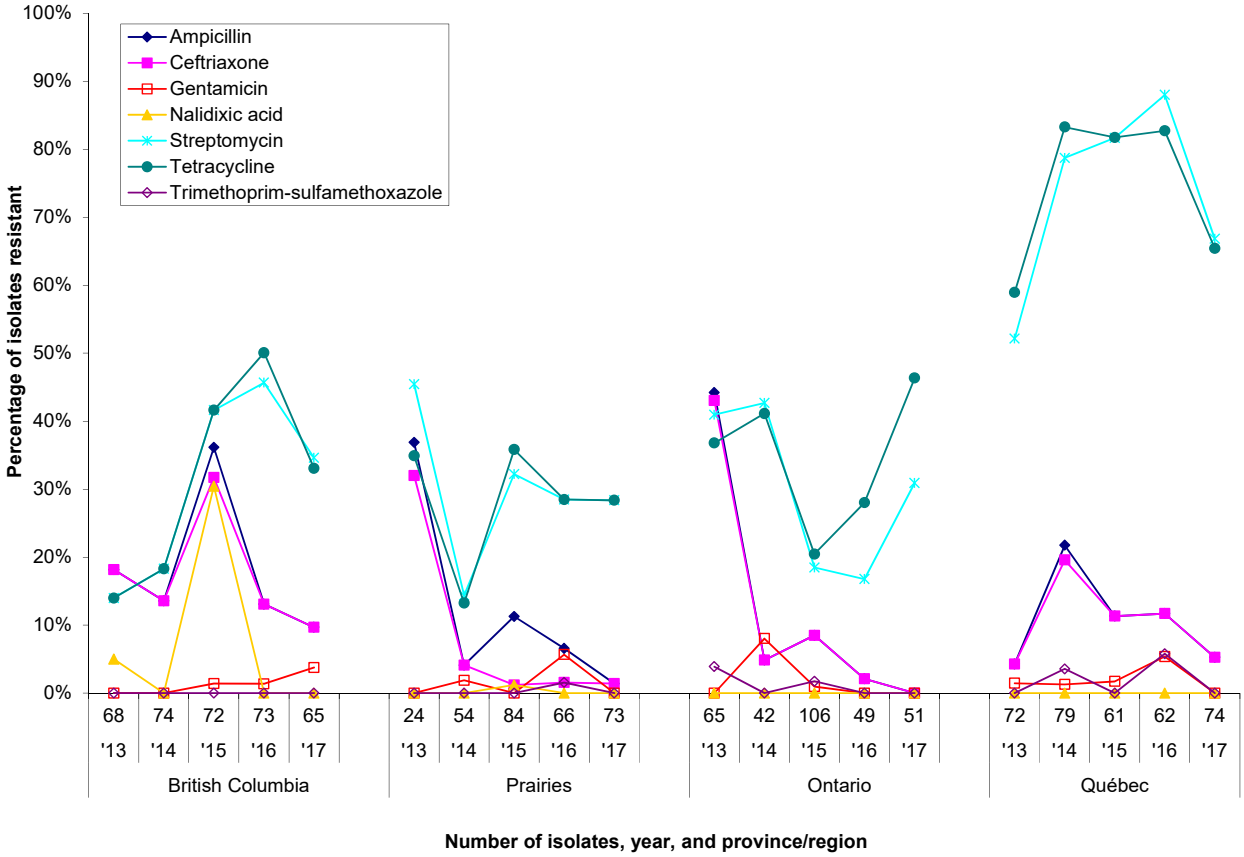
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	43	57	37	58	59	31	46	44	40	48	64	65	66	70	65	53	66	39	52	65
Antimicrobial																				
Ampicillin	76%	49%	41%	56%	44%	81%	43%	31%	38%	16%	50%	36%	49%	44%	37%	46%	65%	60%	42%	45%
Ceftriaxone	67%	33%	21%	18%	15%	68%	13%	12%	21%	4%	19%	12%	22%	20%	22%	21%	37%	42%	11%	12%
Gentamicin	14%	22%	70%	33%	32%	39%	22%	20%	14%	23%	25%	28%	21%	23%	31%	44%	49%	58%	39%	34%
Nalidixic acid	2%	11%	8%	18%	13%	7%	4%	2%	8%	6%	2%	0%	2%	0%	2%	4%	3%	0%	0%	3%
Streptomycin	21%	52%	66%	46%	54%	33%	45%	23%	17%	37%	28%	38%	46%	33%	42%	53%	74%	79%	68%	51%
Tetracycline	44%	53%	33%	59%	63%	59%	61%	45%	50%	49%	61%	47%	60%	51%	60%	66%	79%	80%	58%	52%
Trimethoprim-sulfamethoxazole	7%	3%	3%	7%	9%	6%	11%	0%	2%	4%	16%	9%	9%	7%	3%	20%	16%	18%	13%	14%

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

For the temporal analyses by 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 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/region and antimicrobial.

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

Figure 3. 30 Temporal variations in resistance of *Salmonella* isolates from chickens at pre-harvest, 2013 to 2017



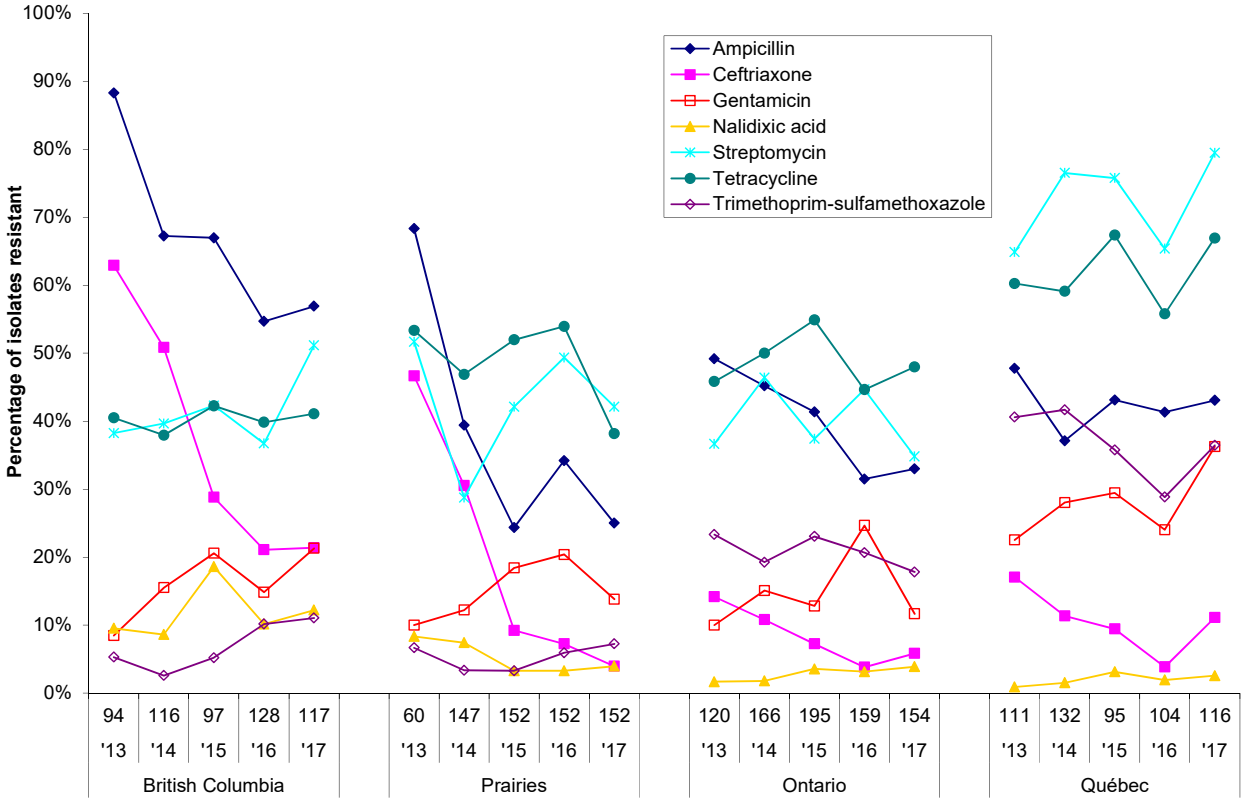
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	68	74	72	73	65	24	54	84	66	73	65	42	106	49	51	72	79	61	62	74
Antimicrobial																				
Ampicillin	18%	14%	36%	13%	10%	37%	4%	11%	7%	1%	44%	5%	8%	2%	0%	4%	22%	11%	12%	5%
Ceftriaxone	18%	14%	32%	13%	10%	32%	4%	1%	2%	1%	43%	5%	8%	2%	0%	4%	20%	11%	12%	5%
Gentamicin	0%	0%	1%	1%	4%	0%	2%	0%	6%	0%	0%	8%	1%	0%	0%	1%	1%	2%	5%	0%
Nalidixic acid	5%	0%	30%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Streptomycin	14%	18%	42%	46%	35%	45%	14%	32%	28%	28%	41%	43%	18%	17%	31%	52%	79%	82%	88%	67%
Tetracycline	14%	18%	42%	50%	33%	35%	13%	36%	28%	28%	37%	41%	20%	28%	46%	59%	83%	82%	83%	65%
Trimethoprim-sulfamethoxazole	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	4%	0%	2%	0%	0%	0%	4%	0%	6%	0%

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

For the temporal analyses by 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 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/region and antimicrobial.

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

Figure 3. 31 Temporal variations in resistance of *Escherichia coli* isolates from chickens at pre-harvest, 2013 to 2017



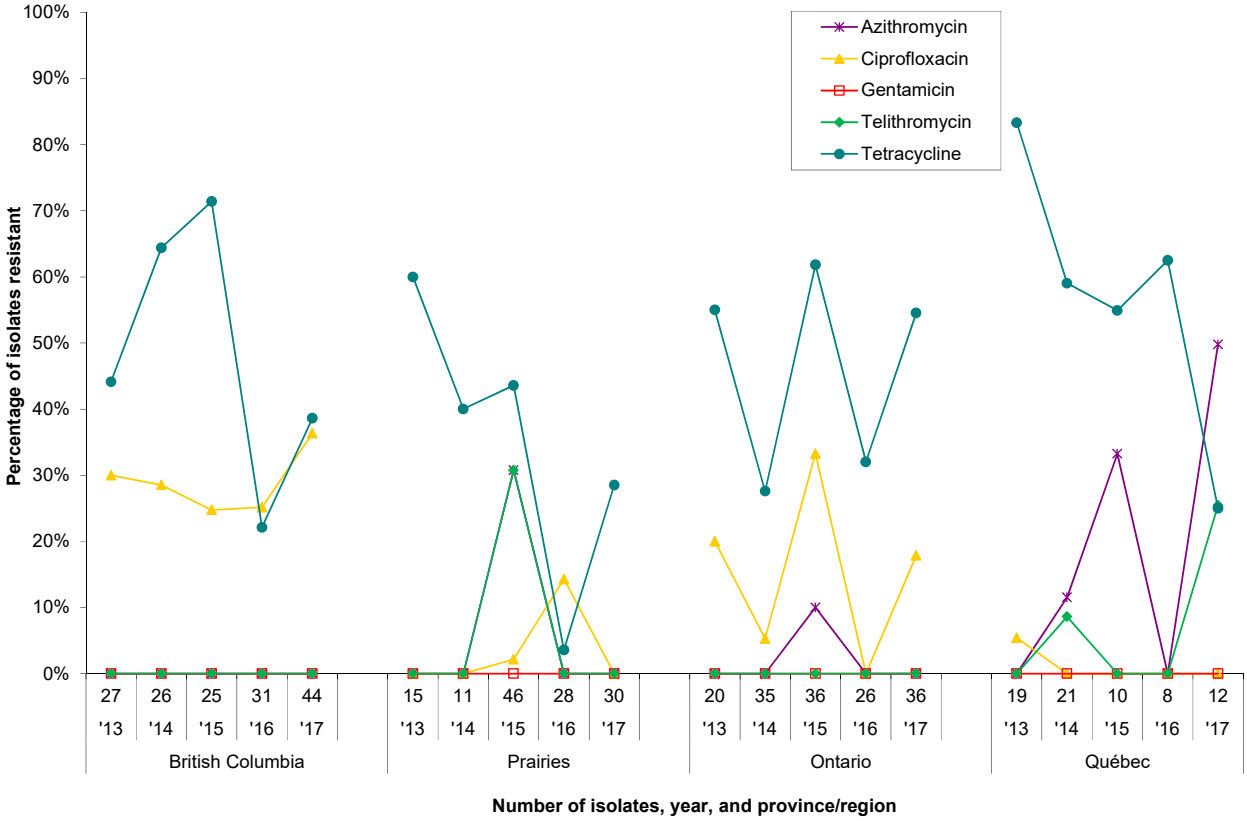
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	94	116	97	128	117	60	147	152	152	152	120	166	195	159	154	111	132	95	104	116
Antimicrobial																				
Ampicillin	88%	67%	67%	55%	57%	68%	39%	24%	34%	25%	49%	45%	41%	31%	33%	48%	37%	43%	41%	43%
Ceftriaxone	63%	51%	29%	21%	21%	47%	31%	9%	7%	4%	14%	11%	7%	4%	6%	17%	11%	9%	4%	11%
Gentamicin	8%	16%	21%	15%	21%	10%	12%	18%	20%	14%	10%	15%	13%	25%	12%	23%	28%	29%	24%	36%
Nalidixic acid	10%	9%	19%	10%	12%	8%	7%	3%	3%	4%	2%	2%	4%	3%	4%	1%	2%	3%	2%	3%
Streptomycin	38%	40%	42%	37%	51%	52%	29%	42%	49%	42%	37%	46%	37%	45%	35%	65%	77%	76%	65%	79%
Tetracycline	40%	38%	42%	40%	41%	53%	47%	52%	54%	38%	46%	50%	55%	45%	48%	60%	59%	67%	56%	67%
Trimethoprim-sulfamethoxazole	5%	3%	5%	10%	11%	7%	3%	3%	6%	7%	23%	19%	23%	21%	18%	41%	42%	36%	29%	36%

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

For the temporal analyses by 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 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/region and antimicrobial.

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

Figure 3. 32 Temporal variations in resistance of *Campylobacter* isolates from chickens at pre-harvest, 2013 to 2017



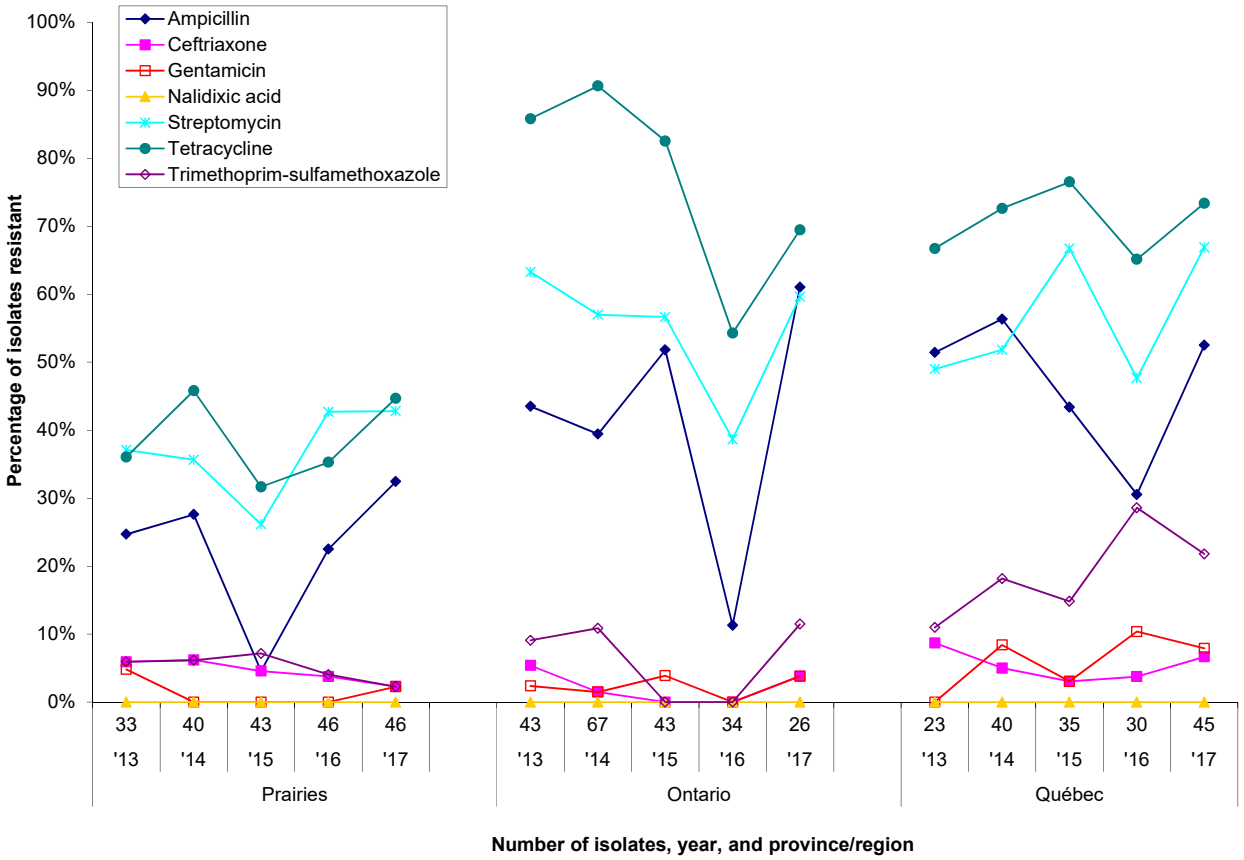
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	27	26	25	31	44	15	11	46	28	30	20	35	36	26	36	19	21	10	8	12
Antimicrobial																				
Azithromycin	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	31%	**0%**	**0%**	**0%**	0%	10%	**0%**	**0%**	**0%**	12%	33%	**0%**	**50%**
Ciprofloxacin	**30%**	29%	25%	**25%**	**36%**	**0%**	0%	2%	**14%**	**0%**	**20%**	5%	33%	**0%**	**18%**	**5%**	0%	0%	**0%**	**0%**
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%**	0%	31%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	9%	0%	**0%**	**25%**
Tetracycline	**44%**	64%	71%	**22%**	**39%**	**60%**	40%	44%	**4%**	**29%**	**55%**	28%	62%	**32%**	**55%**	**83%**	59%	55%	**63%**	**25%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

For the temporal analyses by 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 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/region and antimicrobial.

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

Figure 3. 33 Temporal variations in resistance of *Salmonella* isolates from pigs, 2013 to 2017



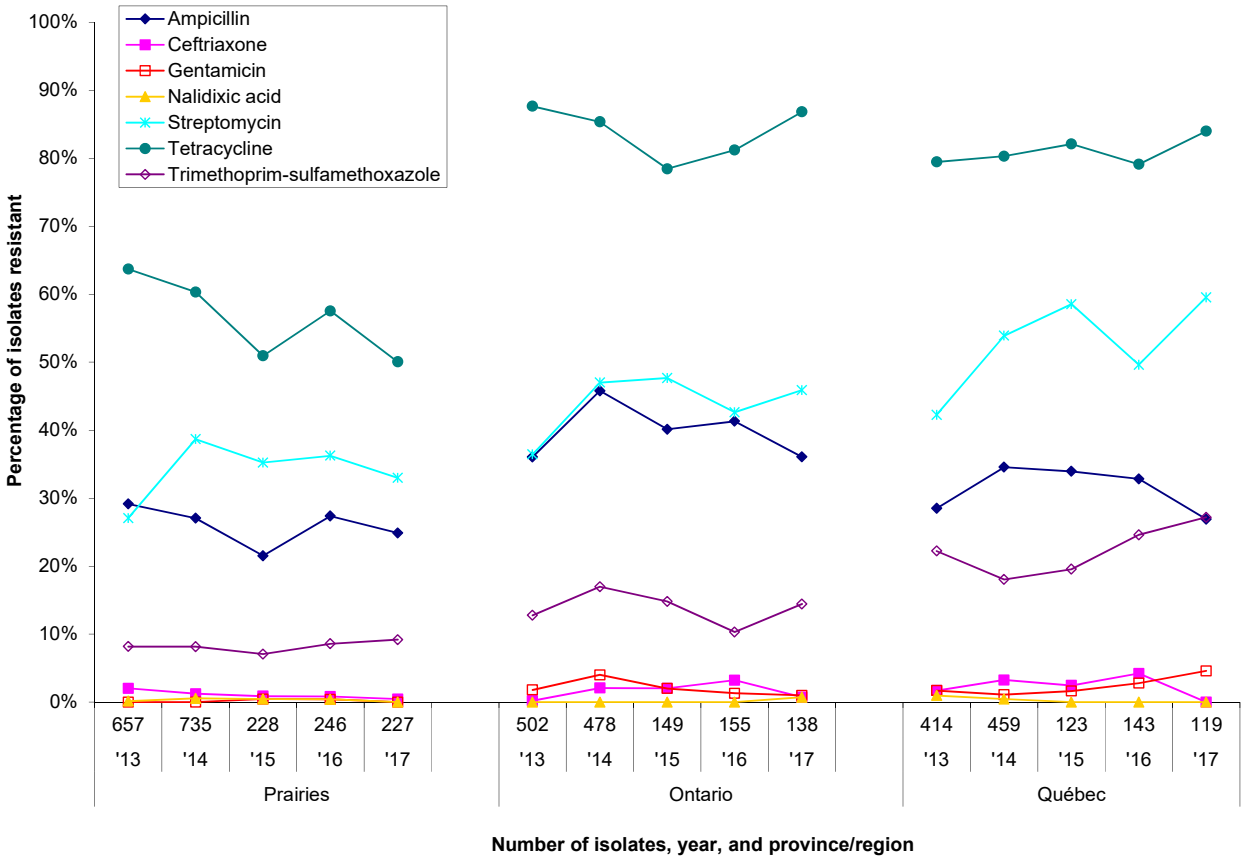
Province/region	Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	33	40	43	46	46	43	67	43	34	26	23	40	35	30	45
Antimicrobial															
Ampicillin	**25%**	28%	5%	**23%**	**32%**	**44%**	39%	52%	**11%**	**61%**	**51%**	56%	43%	**31%**	**52%**
Cefriaxone	**6%**	6%	5%	**4%**	**2%**	**5%**	1%	0%	**0%**	**4%**	**9%**	5%	3%	**4%**	**7%**
Gentamicin	**5%**	0%	0%	**0%**	**2%**	**2%**	1%	4%	**0%**	**4%**	**0%**	8%	3%	**10%**	**8%**
Nalidixic acid	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
Streptomycin	**37%**	36%	26%	**43%**	**43%**	**63%**	57%	57%	**39%**	**60%**	**49%**	52%	67%	**48%**	**67%**
Tetracycline	**36%**	46%	32%	**35%**	**45%**	**86%**	91%	83%	**54%**	**69%**	**67%**	73%	77%	**65%**	**73%**
Trimethoprim-sulfamethoxazole	**6%**	6%	7%	**4%**	**2%**	**9%**	11%	0%	**0%**	**11%**	**11%**	18%	15%	**29%**	**22%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per herd.

For the temporal analyses by 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. 34 Temporal variations in resistance of *Escherichia coli* isolates from pigs, 2013 to 2017



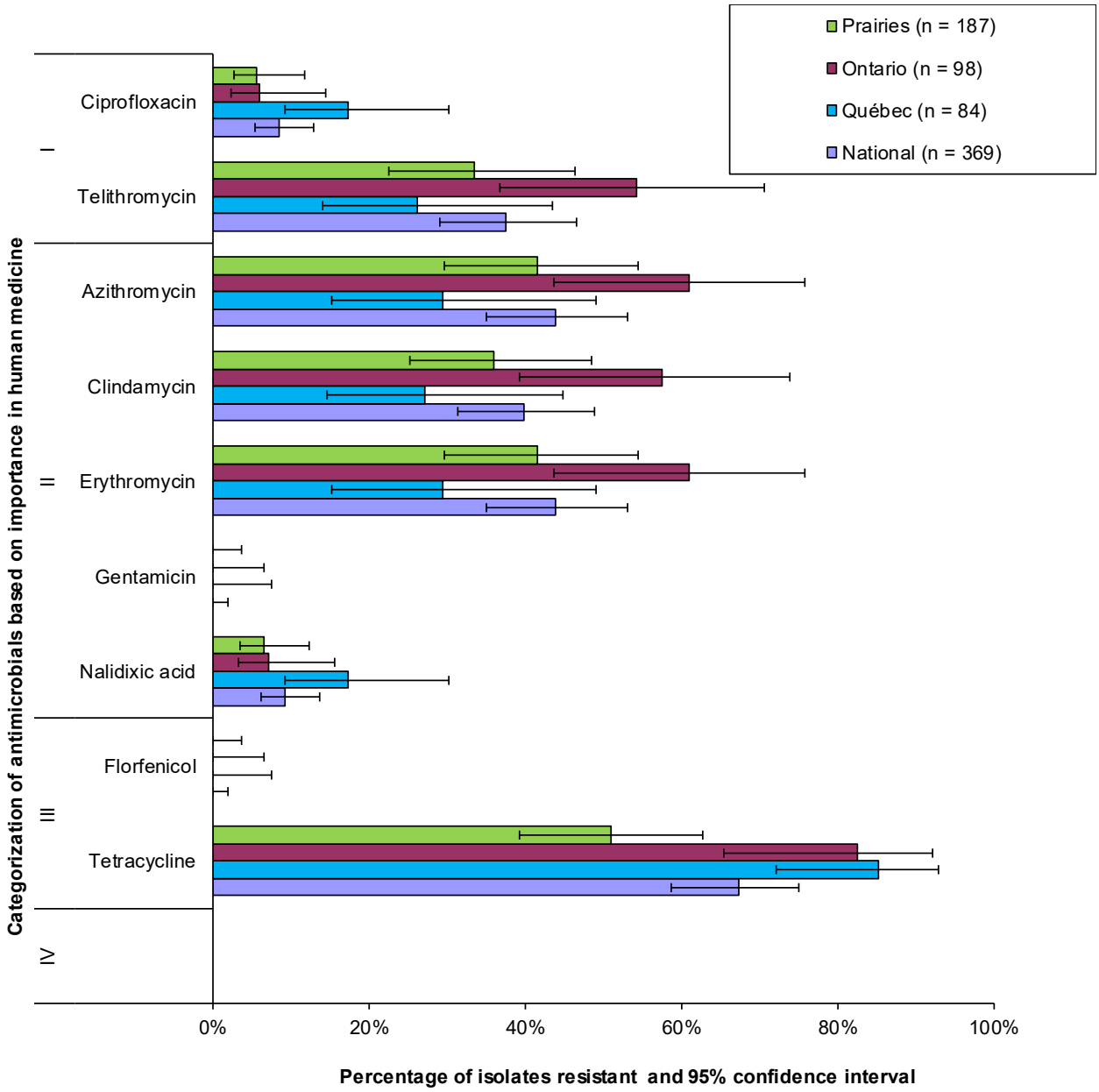
Province/region	Prairies					Ontario					Québec				
Year	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17	'13	'14	'15	'16	'17
Number of isolates	657	735	228	246	227	502	478	149	155	138	414	459	123	143	119
Antimicrobial															
Ampicillin	**29%**	27%	22%	**27%**	**25%**	**36%**	46%	40%	**41%**	**36%**	**28%**	35%	34%	**33%**	**27%**
Cefriaxone	**2%**	1%	1%	**1%**	**0%**	**0%**	2%	2%	**3%**	**1%**	**2%**	3%	2%	**4%**	**0%**
Gentamicin	**0%**	0%	0%	**0%**	**0%**	**2%**	4%	2%	**1%**	**1%**	**2%**	1%	2%	**3%**	**5%**
Nalidixic acid	**0%**	1%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**1%**	**1%**	0%	0%	**0%**	**0%**
Streptomycin	**27%**	39%	35%	**36%**	**33%**	**36%**	47%	48%	**43%**	**46%**	**42%**	54%	59%	**50%**	**60%**
Tetracycline	**64%**	60%	51%	**58%**	**50%**	**88%**	85%	78%	**81%**	**87%**	**79%**	80%	82%	**79%**	**84%**
Trimethoprim-sulfamethoxazole	**8%**	8%	7%	**9%**	**9%**	**13%**	17%	15%	**10%**	**14%**	**22%**	18%	20%	**25%**	**27%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per herd.

For the temporal analyses by 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.

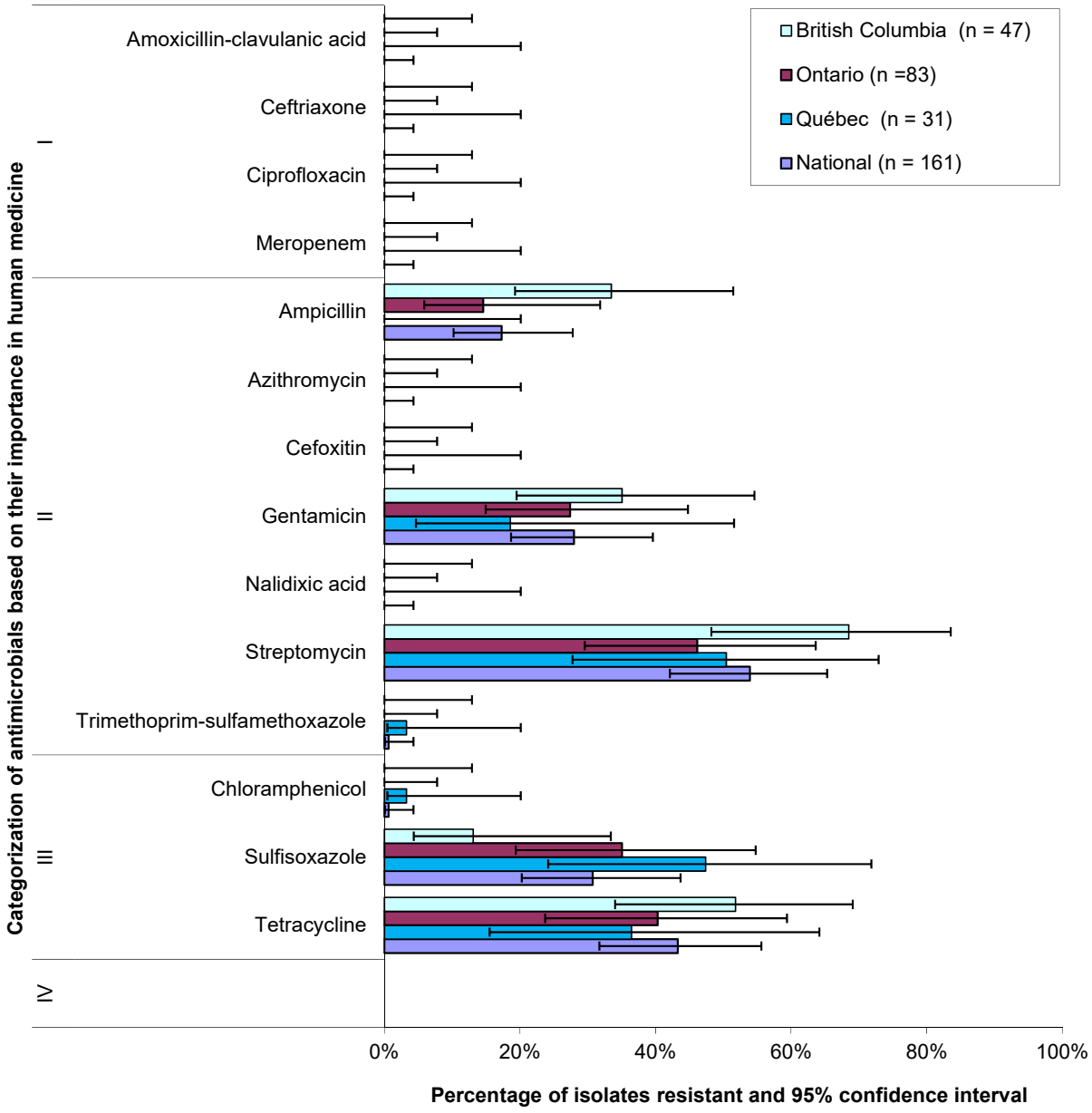
The Prairies region includes Alberta, Saskatchewan, and Manitoba.

Figure 3. 35 Resistance of *Campylobacter* isolates from pigs, 2017



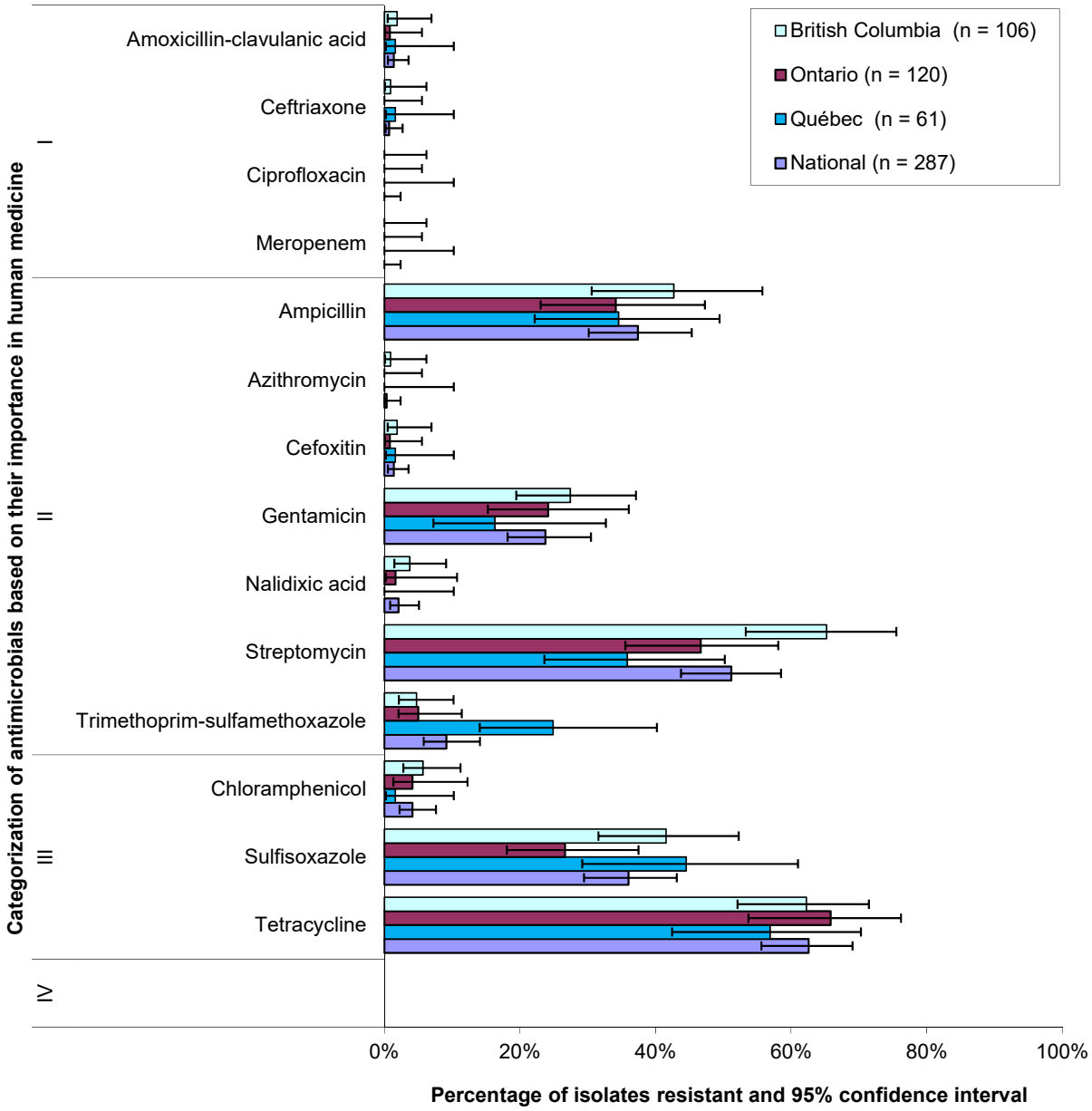
The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

Figure 3. 36 Resistance of *Salmonella* isolates from turkeys, 2017



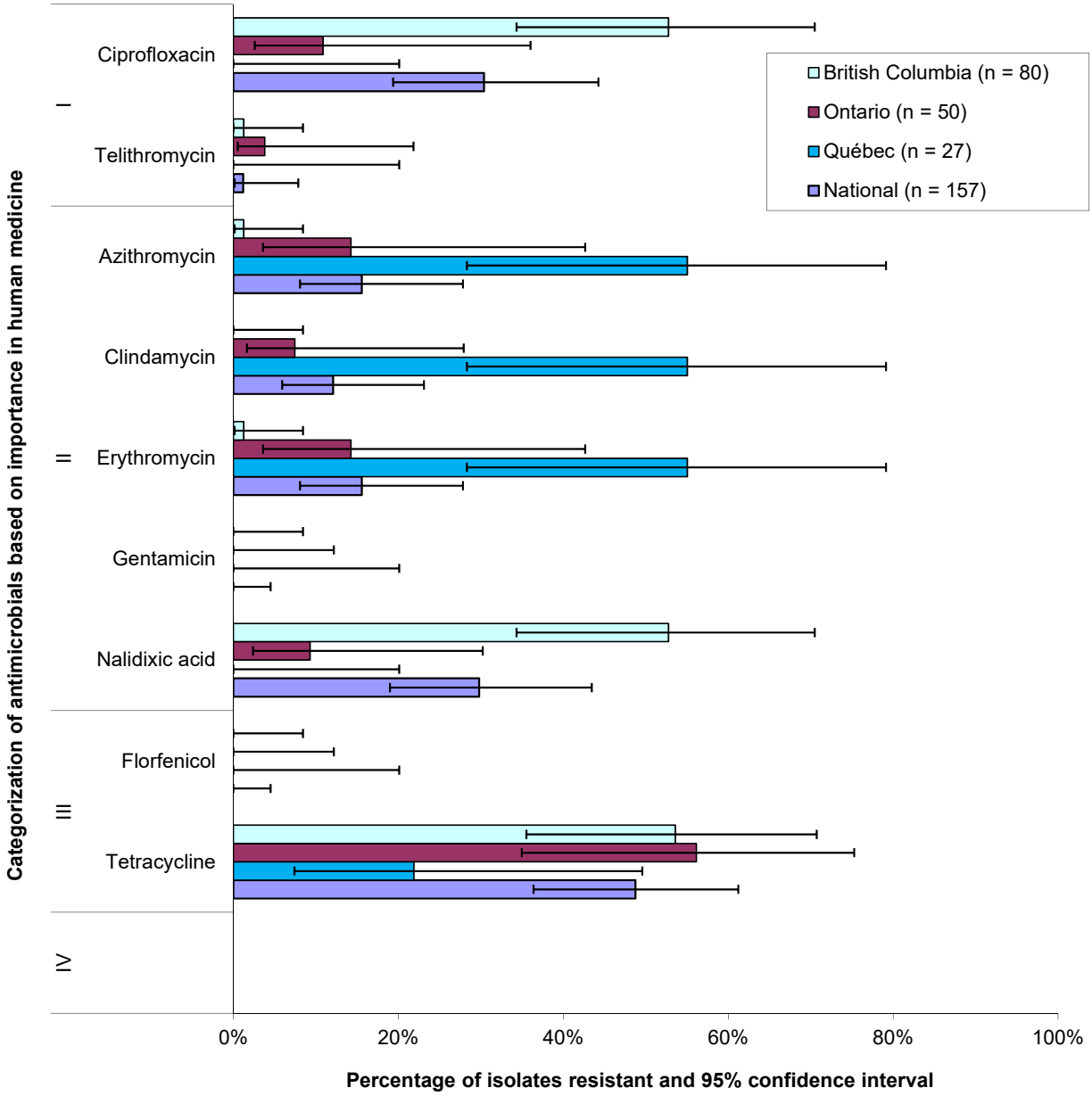
The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

Figure 3. 37 Resistance of *Escherichia coli* isolates from turkey, 2017



The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

Figure 3. 38 Resistance of *Campylobacter* isolates from turkeys, 2017



The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

Recovery results

Table 3. 32Farm Surveillance recovery rates in feedlot beef, 2017

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	National	2016	**100%**	78/78	**4%**	3/78	**72%**	56/78
		2017	**99%**	75/76	**1%**	1/76	**57%**	43/76

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. 33 Farm Surveillance recovery rates in chickens, 2013 to 2017

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 (Chick placement)	British Columbia	2013	**72%**	43/60	**28%**	17/60		
		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		
	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		
	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		
	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		
	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		

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 chickens, 2013 to 2017 (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	
	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	
	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	
	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	
	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	

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. 34 Farm Surveillance recovery rates in pigs, 2006 to 2017

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		
	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		
	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		
	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		

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. 35 Farm Surveillance recovery rates in turkeys, 2017

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	
	Ontario	2016	**97%**	113/116	**60%**	70/116	**56%**	65/116	
		2017	**100%**	120/120	**69%**	83/120	**42%**	50/120	
	Québec	2016	**100%**	48/48	**54%**	26/48	**56%**	27/48	
		2017	**95%**	61/64	**48%**	31/64	**42%**	27/64	
	National	2016	**99%**	277/280	**52%**	146/280	**61%**	171/280	
		2017	**98%**	287/292	**55%**	161/292	**54%**	157/292	

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. 36 Number of antimicrobial classes in resistance patterns of *Salmonella* from cattle, 2017

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	53 (35.3)	1		4	23	25		52	42	42	41	41		52	4		46	5	29	52
Typhimurium	39 (26)	10		3	25	1		27	29	1	3	1		29	20		27	1	1	26
4,[5],12:i:-	14 (9.3)	3			11		3	11	11					11	8		8			11
Cerro	11 (7.3)	10	1					1												
Infantis	4 (2.7)	3			1			1						1			1			1
Give	3 (2)	2				1	1	1	1		1			1	1	1	1	1		
Heidelberg	3 (2)				1	2		3	3	1	1	1		3	3	2	3			3
6,14,18:-:-	3 (2)	3																		
Muenster	3 (2)			1	2				2		1			3	3		3			2
Uganda	3 (2)	2				1		1	1					1			1	1	1	1
Less common serovars	14 (9.3)	10	2		1	1	1	2	2	2	2	2		2	1		2		1	4
Total	**150 (100)**	**44**	**3**	**8**	**64**	**31**	**5**	**99**	**91**	**46**	**49**	**45**		**103**	**40**	**3**	**92**	**8**	**32**	**100**

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 chickens, 2017

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	112 (58.0)	111		1					1											1
Kentucky	36 (18.7)	5	1	27	3			30	11	11	11	11		1	1		1		2	30
Typhimurium	10 (5.2)	5	2	3				3						3						3
Heidelberg	8 (4.1)	4	1	3			3	4						3						
4,[5],12:i:-	5 (2.6)	3	2					2												
Less common serovars	22 (11.4)	16	2	4			2	5	1	1	1	1		1	1					5
Total	**193 (100)**	**144**	**8**	**38**	**3**		**5**	**44**	**13**	**12**	**12**	**12**		**8**	**2**		**1**		**2**	**39**

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 pigs, 2017

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	131 (34.4)	25	5	17	83	1	15	92	88	4	3	3		98	22	4	75			97
4,[5],12:i:-	58 (15.2)		1	2	53	2	6	56	57		2			55	9	6	8	1	1	58
Derby	54 (14.2)	7	8	32	7		4	35	12	6	6	7		33	4		2			44
Infantis	29 (7.6)	17	4	1	5	2	4	8	9	8	8	8		8	3	2	7			9
Brandenburg	10 (2.6)	3	5	1	1		1	1	2					1	1	1				5
Mbandaka var. 14+	9 (2.4)	1		3	5		3	8	5					7			2			8
Less common serovars	90 (23.6)	26	9	23	32		9	51	29	13	16	16		56	14		21			57
Total	**381 (100)**	**79**	**32**	**79**	**186**	**5**	**42**	**251**	**202**	**31**	**35**	**34**		**258**	**53**	**13**	**115**	**1**	**1**	**278**

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. 39 Number of antimicrobial classes in resistance patterns of *Salmonella* from horses, 2017

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	4 (33.3)	4																		
Bareilly	2 (16.7)	2																		
Augustenborg	1 (8.3)	1																		
Berta	1 (8.3)	1																		
Heidelberg	1 (8.3)			1					1		1									1
4,[5],12:i:-	1 (8.3)				1		1	1						1	1		1		1	1
Oranienburg	1 (8.3)	1																		
Thompson	1 (8.3)	1																		
Total	**12 (100)**	**10**		**1**	**1**		**1**	**1**	**1**		**1**			**1**	**1**		**1**		**1**	**2**

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. 40 Number of antimicrobial classes in resistance patterns of *Salmonella* from turkeys, 2017

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	8 (11.8)	2	1	5			5	5	1					6	1					
Muenchen	7 (10.3)	6		1			1	1						1						1
Schwarzengrund	7 (10.3)	5		2			2	2						2						2
Anatum	6 (8.8)	1		5			1	5	4					1						5
Senftenberg	5 (7.4)	2		3			3	3	3											
Hadar	4 (5.9)			3	1		1	4	2					1						4
Montevideo	4 (5.9)		1	3			4	4	3											
Uganda	4 (5.9)	1		3				3						3						3
Agona	2 (2.9)	1		1			1	1						1						
Albany	2 (2.9)			2			2	2	1											1
Bredeney	2 (2.9)			2			2	2	2	2	2	2		2						
10:l,z13:-	2 (2.9)	1		1				1						1						1
Indiana	2 (2.9)				1	1	1	2	2	2	2	2		2	1	1	2			2
Liverpool	2 (2.9)			2			1	2	1					1						
Reading	2 (2.9)				2			2	2					2						2
Thompson	2 (2.9)	2																		
Less common serovars	7 (10.3)	3		4			3	4	2	1	1	1		3						2
Total	**68 (100)**	**24**	**2**	**37**	**4**	**1**	**27**	**43**	**23**	**5**	**5**	**5**		**26**	**2**	**1**	**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".

Surveillance of Feed and Feed Ingredients

Multiclass resistance

Table 3. 41 Number of antimicrobial classes in resistance patterns of *Salmonella* from feed and feed ingredients, 2017

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
Montevideo	6 (21.4)	6																		
Schwarzengrund	5 (17.9)	3		2				2						2						2
Senftenberg	3 (10.7)	2	1					1												
Agona	2 (7.1)	2																		
Braenderup	2 (7.1)	2																		
Cubana	2 (7.1)	2																		
Mbandaka	2 (7.1)	2																		
Meleagridis	2 (7.1)	2																		
Ohio var. 14+	2 (7.1)	2																		
10:-:1,6	1 (3.6)	1																		
Othmarschen	1 (3.6)	1																		
Total	**28 (100)**	**25**	**1**	**2**				**3**						**2**						**2**

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[8]

Prairies: AB, SK, MB
Maritimes: NB, NS, PE
Atlantic[9]: 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

[8] In 2017, not all provinces are represented in each surveillance component for the Prairies and the Atlantic region.
[9] In 2017, no sampling occurred in the Atlantic region.

Important resistance patterns

A2C-AMP Amoxicillin-clavulanic acid, cefoxitin, ceftiofur, and ampicillin

ACSSuT Ampicillin, chloramphenicol, streptomycin, sulfisoxazole, and tetracycline

Other abbreviations

APP *Actinobacillus pleuropneumoniae*

APEC Avian pathogenic *Escherichia coli*

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