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Canada

2018

CIPARS

Canadian Integrated Program for Antimicrobial Resistance Surveillance

Broiler Chickens

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health, Public Health Agency of Canada

Working towards the preservation of effective antimicrobials for humans and animals, Canadian Integrated Program for Antimicrobial Resistance Surveillance

Également disponible en français sous le titre :

Programme intégré canadien de surveillance de la résistance aux antimicrobiens (PICRA) de 2018 : Poulets de chair

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This publication can be made available in alternative formats upon request.

Publication date: April 2022

Cat.: HP2-4/2018E-5-PDF

ISBN: 978-0-660-42409-5

Pub.: 210735

Suggested Citation:

Government of Canada. Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) 2018: Broiler Chickens. Public Health Agency of Canada, Guelph, Ontario, 2022.

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Broiler Chickens

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Acknowledgements

We are grateful for 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 – broiler chicken component:

- Alberta Chicken Producers
- British Columbia Chicken Marketing Board
- Canadian Hatcheries Federation
- Canadian Poultry and Egg Processors Council
- Chicken Farmers of Canada
- Chicken Farmers of Ontario
- CIPARS Farm Broiler Chicken Industry Antimicrobial Use/Resistance Working Group
- Les Éleveurs de volailles du Québec
- Alberta Agriculture and Forestry
- Saskatchewan Agriculture

Chapter 1 Animal health status and farm information

The data presented in this section pertains to pertinent farm-level animal health status and CIPARS sentinel farm information for broiler chickens. These are relevant to antimicrobial use and antimicrobial resistance.

Broiler chickens

Key findings

Mortality

- The median mortality rate in the broiler flocks surveyed was similar to 2017 (4%; 1 to 14%). Mortality rate varied by marketing category: mainstream RWA/ABF (raised without antibiotics/antibiotic-free program) (5%; 2 to 10%), conventional (4%; 1 to 14%), organic (7%), and other categories such as flocks raised according to CFIA's updated methods of production claim definitions for RWA/ABF[1] (4%).

Chick sources

- Overall, the total number of chicks placed in the sampling unit (barn/floor/pen sampled for microbiological testing) in 2018 was similar to the previous years and comprised of 83% domestic, 13% imported and 4% from other provinces (Figure 1. 1). There were provincial/regional variations in chick origin (sourced domestically, other provinces and internationally) (Figure 1. 2).
- By production type category, 76% of the flocks (85% of the total bird population surveyed) sampled were classified as conventional and were fed or medicated via water or injection with any of the antimicrobials listed in Table 2. 3 (i.e., excluding coccidiostats). The remaining 24% of the flocks (15% of total bird population surveyed) were deemed organic and RWA/ABF mainstream program or according to the revised CFIA method of production claim; total number of flocks in these production types increased by 6% from 2017.

Diagnosis of disease in broiler flocks

- The diagnosis of APEC (avian pathogenic *Escherichia coli)* associated diseases increased overall between 2017 (18%) to 2018 (28%) and the increase was noted in all the provinces/regions. Between 2017 and 2018, the diagnosis of necrotic enteritis and coccidiosis increased from 2% to 4% and from 8% to 13%, respectively. During the same period (2017 and 2018), viral disease infections reportedly diagnosed increased; notably Reovirus (2 to 6%), Inclusion Body Hepatitis (2 to 7%) and Infectious Bronchitis Virus (2 to 4%).

[1] CFIA. Chapter Method of Production Claims. Method of Production Claims for Meat, Poultry and Fish Products. Available at : http://inspection.gc.ca/food/labelling/food-labelling-for-industry/method-of-production-claims/eng/1389379565794/1389380926083?chap=7. Accessed June 2018.

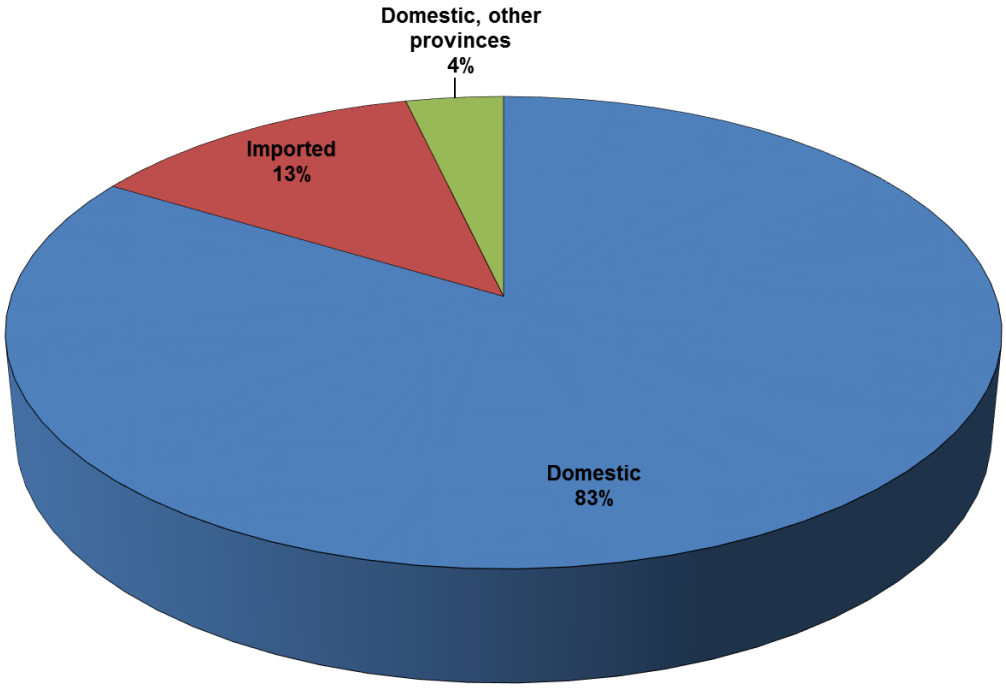
Biosecurity

- As for biosecurity practices, observance of downtime and rest period of 15 days (2 to 35 days) was reported.

Vaccinations

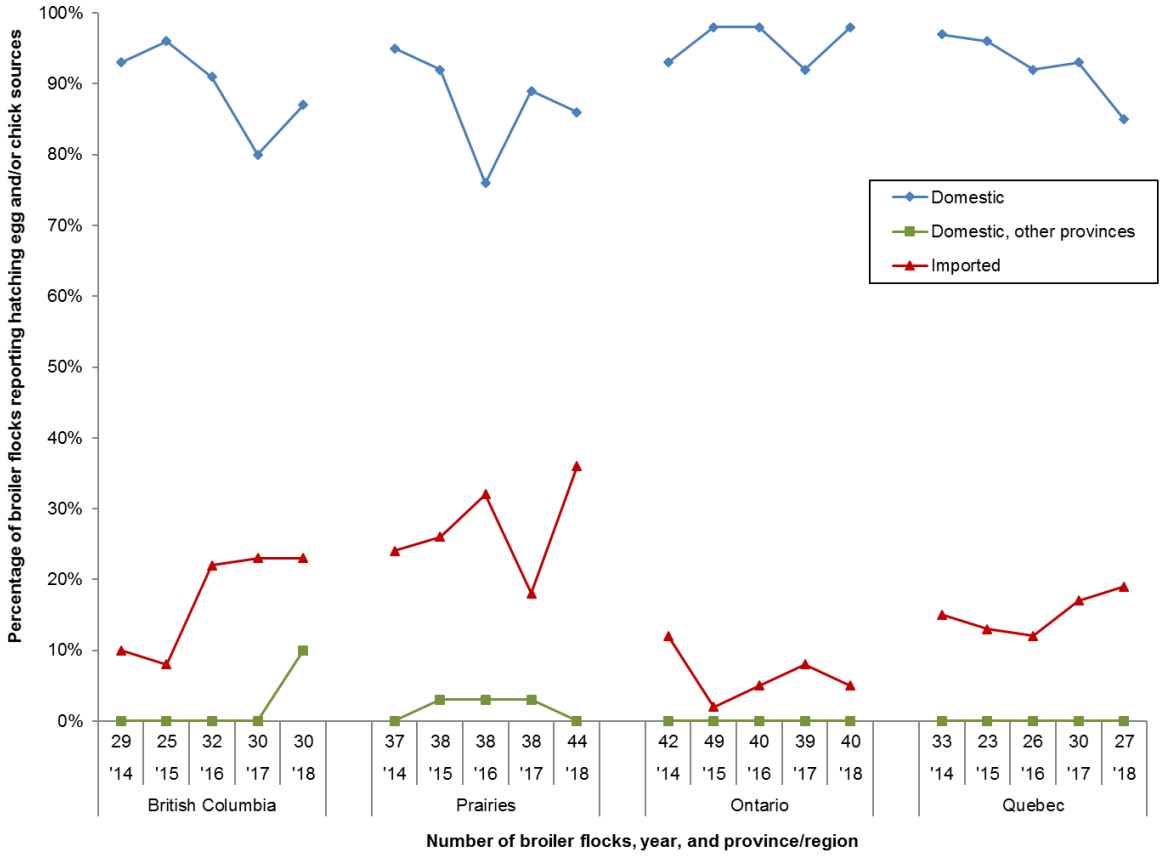
- Routine vaccination of broilers at the hatchery (91% of flocks) and on-farm (20% of flocks) against common viral, bacterial and protozoal pathogens affecting broilers in Canada were practiced by the participating producers to manage flock health. Notably, coccidiosis vaccination increased from 10% in 2017 to 18% in 2018.

Figure 1. 1 Relative distribution of chick sources, 2018



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.

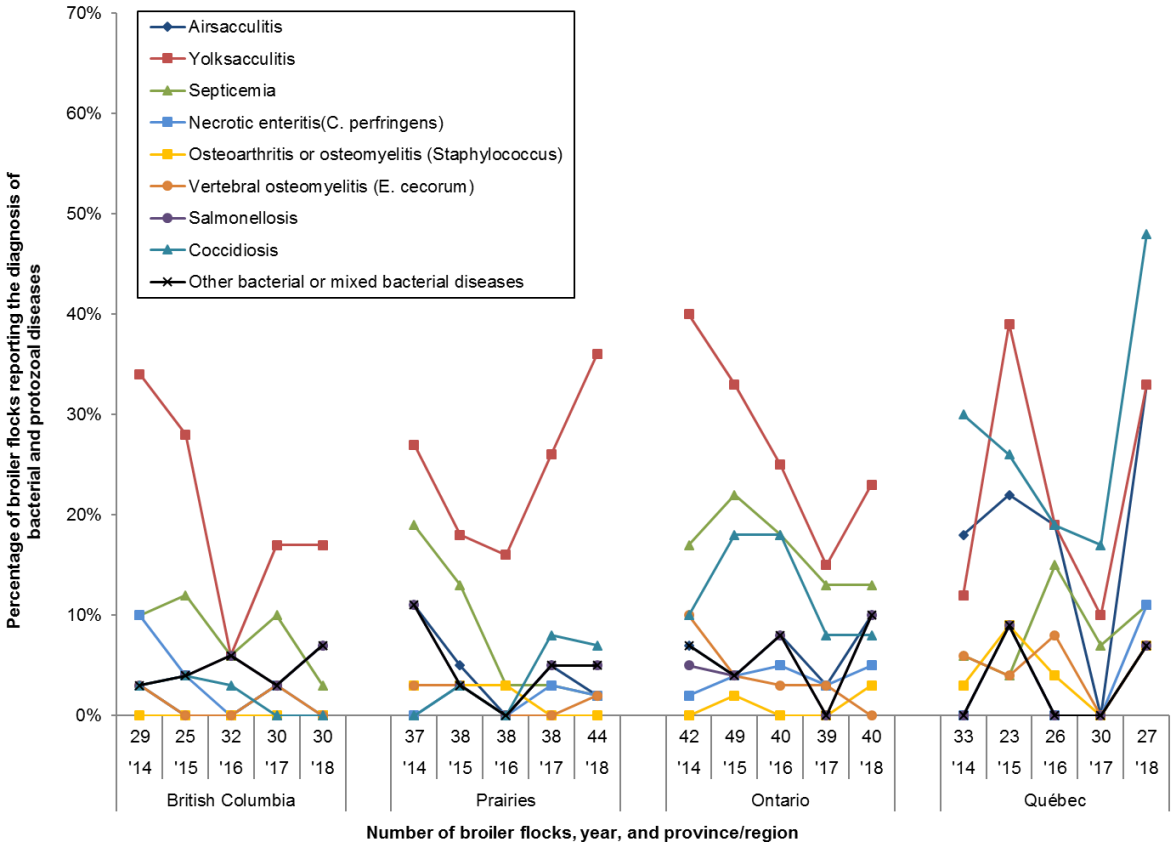
Figure 1. 2 Sources of hatching eggs and/or chicks placed in the barn sampled, 2014 to 2018



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

Domestic 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, 2014 to 2018



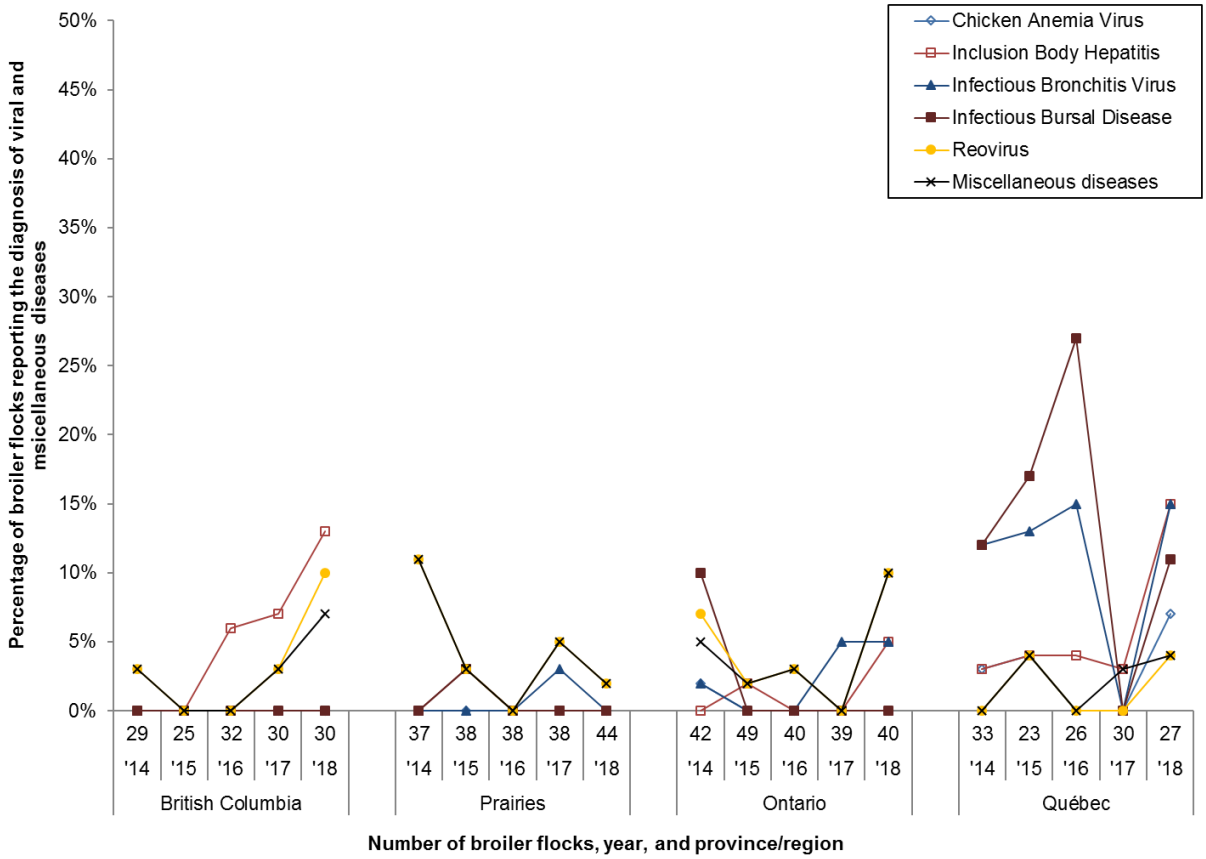
Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks	29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Diseases																				
Airsacculitis	3%	0%	0%	3%	7%	11%	5%	0%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

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

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

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

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



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

Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive" plus a response to any or combination of the following: clinical sign, post-mortem or laboratory testing to confirm the diagnosis. Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

In 2018, nicarbazine toxicity was reported (miscellaneous noninfectious disease).
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Chapter 2 Antimicrobial use in broiler chickens

Farm Surveillance in broiler chickens[2]

Key findings

Total antimicrobials used

- Overall, the quantity of antimicrobials decreased marginally between 2017 and 2018 by 1% in terms of mg/PCU (Figure 2. 1) and nDDDvetCA/1,000 broiler chicken-days at risk by 7% (Figure 2. 3). There were provincial/regional variations noted but the Prairies had the greatest magnitude of decrease at 16% and 25% in terms of mg/PCU and nDDDvetCA/1000 broiler chicken-days at risk, respectively. British Columbia had the highest magnitude of increase in mg/PCU (16%) and nDDDvetCA/1,000 chicken-days at risk (25%) as a result of a change in the quantity of penicillins administered via feed (Figure 2. 6 and Figure 2. 7).

Administration in feed

- Antimicrobials administered via feed represented the greatest route of administration/exposure in terms of frequency and quantity (Table 2. 2, Figure 2. 1, Figure 2. 2, and Figure 2. 3). The top 3 most frequently used antimicrobial classes in terms of mg/PCU were bacitracins, penicillins and trimethoprim-sulfonamides. The top 2 antimicrobial classes (bacitracins and penicillins) were reportedly used for the prevention of necrotic enteritis and trimethoprim-sulfonamides were used for the treatment of systemic and respiratory diseases.

Administration in water

- As in the previous years, the proportion of producers that reported the use of antimicrobials via water was relatively low, but increased from 7% (2017) to 10% (Figure 2. 8). There were no marked differences in frequency observed between the provinces/regions (Figure 2. 9). The total quantity of antimicrobials used via this route contributed to 7% of the total quantity of antimicrobials in terms of mg/PCU (Figure 2. 2).
- One producer reportedly used enrofloxacin, a Veterinary Drugs Directorate's Category I antimicrobials via water (Table 2. 2 and Figure 2. 9).

Administration *in ovo* or subcutaneous injection

- Twenty percent (28/141) of broiler producers reported that the chicks delivered to their barn were medicated at the hatchery. This reported use of antimicrobials at the hatchery decreased by 9% from the previous year (Figure 2. 12); the quantity of antimicrobials used by this route has contributed to less than 1% of the overall use in

[2] Please refer to CIPARS 2016 annual report on the detailed antimicrobial use methods (http://publications.gc.ca/collections/collection_2018/aspc-phac/HP2-4-2016-eng.pdf).

terms of mg/PCU. Lincomycin-spectinomycin (16%) and gentamicin (1%) were the antimicrobials administered at the hatchery for the prevention of diseases associated with avian pathogenic *E. coli* such as yolk sac infection and septicemia. The reported frequency of lincomycin-spectinomycin use in 2018 was higher in Québec (56%) compared to the other provinces/regions sampled (3 to 4%) (Figure 2. 13). No flock in Ontario reportedly used any antimicrobial at the hatchery.

- For 4 consecutive years (2015 to 2018), there were no producers that reported the use of Veterinary Drugs Directorate's Category I antimicrobials by injection (Table 2. 2 and Figure 2. 12).

Ionophores, chemical coccidiostats and other antiprotozoal agents

- Coccidiostats used for the prevention of coccidiosis (*Eimeria* spp.), contributed to 62% of the total quantity of antimicrobials used in broilers in 2018, largely similar from 2017. Overall, 70% of the flocks used ionophores and 33% used chemical coccidiostats (Figure 2. 16); the proportion of flocks using specific coccidiostats varied by province/region (Figure 2. 17 and Figure 2. 18). Monensin, narasin-nicarbazin and salinomycin were the top 3 most frequently used coccidiostats (Figure 2. 16). Five percent of the flocks not using coccidiostats and vaccination (Table 2. 1) did not report any program to control coccidiosis.

Summary of antimicrobials used by routes of administration

Table 2. 1 Number of broiler flocks with reported antimicrobial use by route of administration, 2018

Antimicrobial use	Route of administration			
	Any route[a]	*In ovo* /subcutaneous	Feed	Water
	n (%)	n (%)	n (%)	n (%)
Any antimicrobial use	106 (75)	25 (18)	113 (80)	14 (10)
No antimicrobial use	35 (25)	116 (82)	28 (20)	127 (90)
Total flocks	**141 (100)**	**141 (100)**	**141 (100)**	**141 (100)**

[a] Flocks with reported use of an antimicrobial class by feed, water, *in ovo* or 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. 2 (next page).

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

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

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.

[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 standard feed or water consumed (feed and water were estimated based on breed standards).

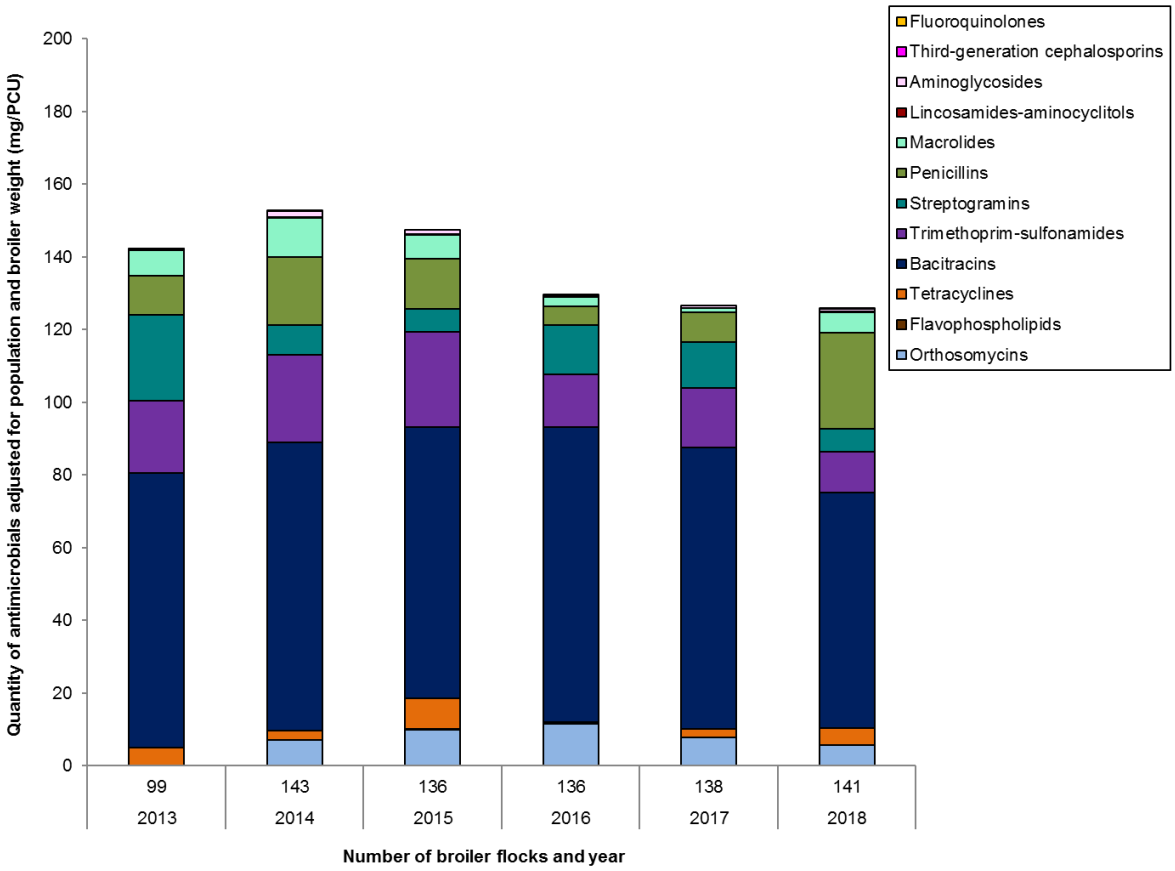
[d] The final mg/PCU and nDDDvetCA/1,000 broiler chicken-days at risk exclude coccidiostats. Flavophospholipids was included only in the mg/PCU.

Table 2. 3 Production, biomass and quantity of antimicrobials use by province/region, 2014 to 2018

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

Some values presented in this report slightly differ from the previous year's reports due to flock size corrections, improvement to the database and methodology refinements.
mg/PCU = milligrams/population correction unit
ESVAC = European Surveillance of Veterinary Antimicrobial Consumption.
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligrams per kilogram broiler chicken per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 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.
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.

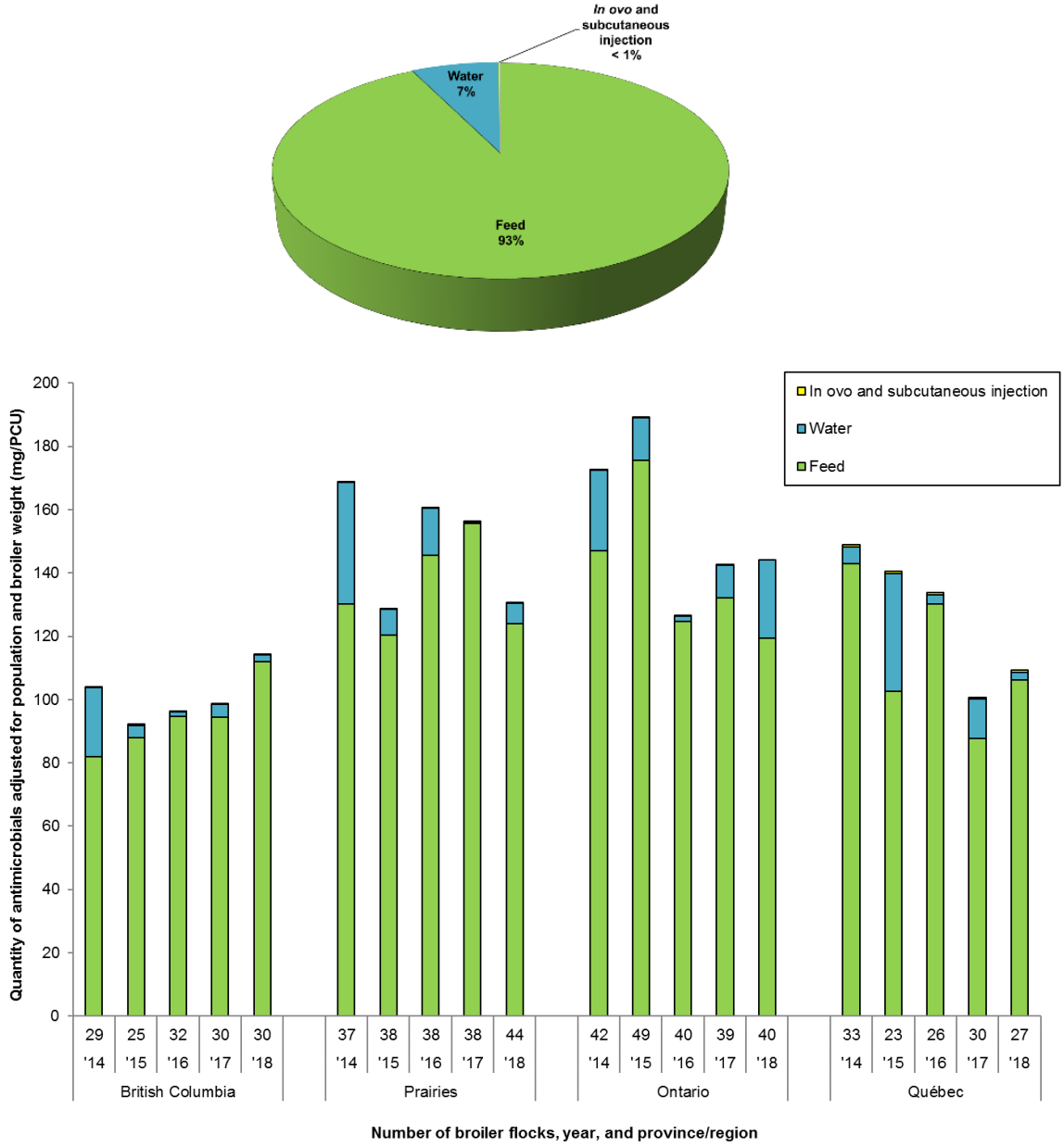
Figure 2. 1 Quantity of antimicrobial use in all routes of administration, adjusted for population and broiler weight (mg/PCU), 2013 to 2018



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

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

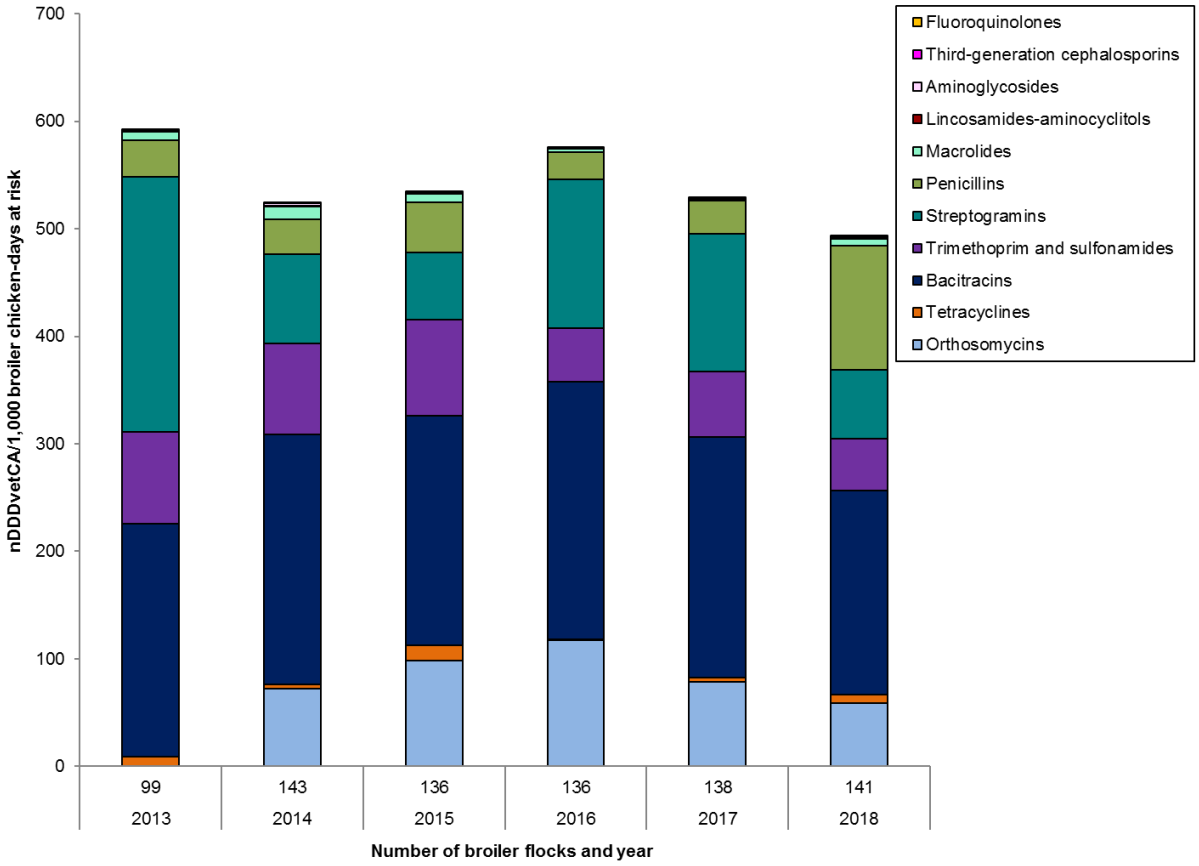
Figure 2. 2 Quantity of antimicrobials, adjusted for population and broiler weight (mg/PCU), in 2018 and by province/region, 2014 to 2018



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

mg/PCU = milligrams/population correction unit.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 2. 3 Number of Canadian Defined Daily Doses for animals per 1,000 broiler chicken-days at risk (nDDDvetCA/1,000 broiler chicken-days at risk) for all routes of administration, 2013 to 2018

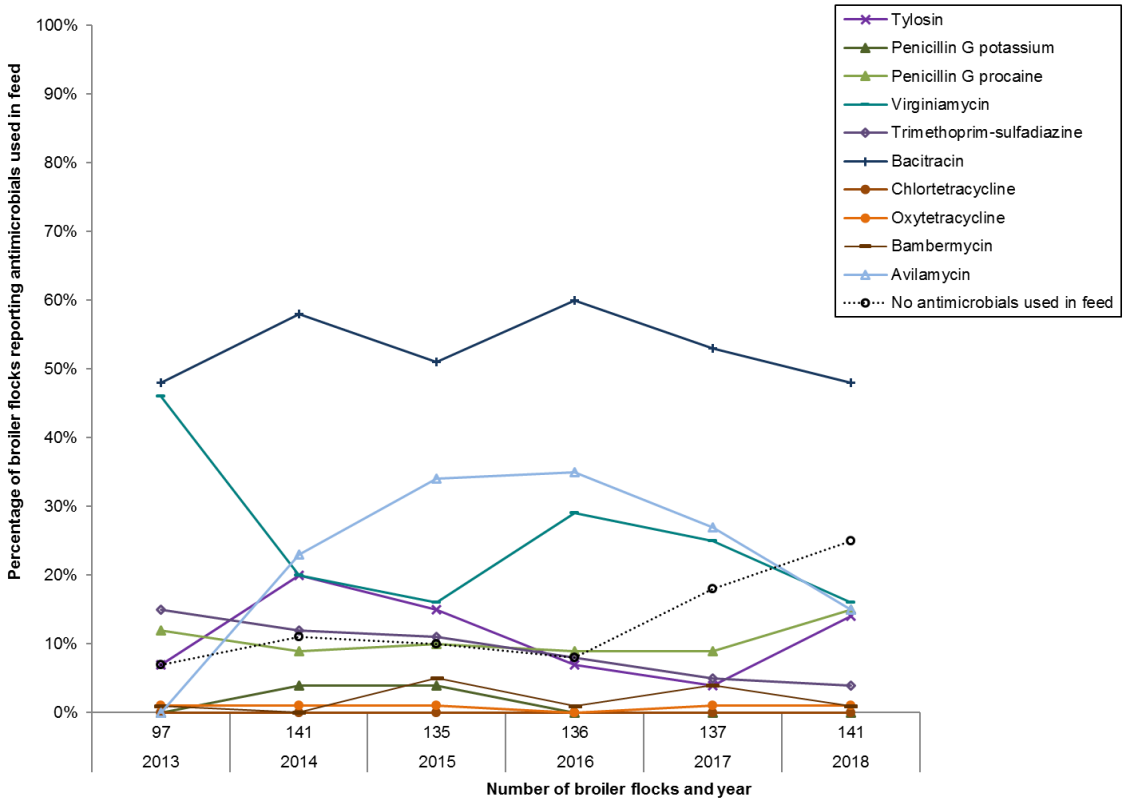


Year		2013	2014	2015	2016	2017	2018
Number of flocks		99	143	136	136	138	141
Antimicrobial class							
I	Fluoroquinolones	< 0.1	0	0	0	0	< 0.1
	Third-generation cephalosporins	1	0.1	0	0	0	0
II	Aminoglycosides	< 0.1	2	2	1	1	1
	Lincosamides-aminocyclitols	1	1	1	0.5	0.5	2
	Macrolides	8	12	7	3	1	6
	Penicillins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

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

Antimicrobial use in feed by frequency

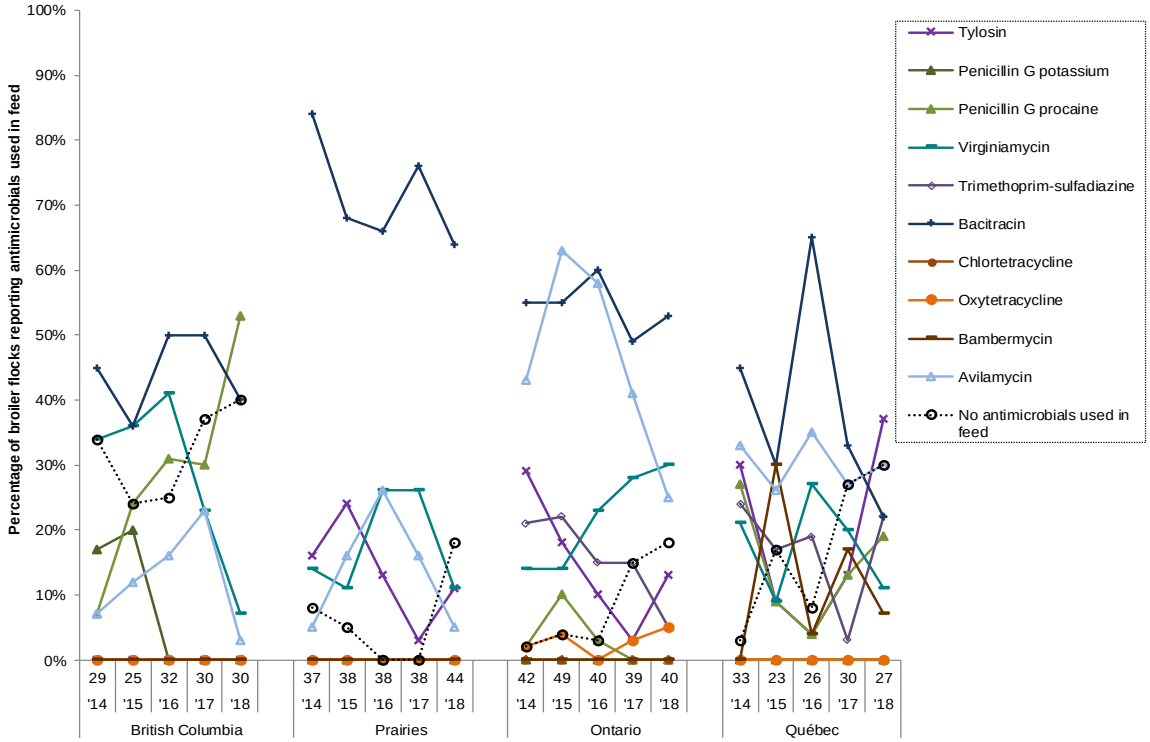
Figure 2. 4 Percentage of broiler flocks reporting antimicrobial use in feed, 2013 to 2018



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

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).
Numbers per column may not add up to 100% as some flocks may have used an antimicrobial more than once or used multiple antimicrobials throughout the grow-out period.
For the temporal analyses, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.
Please note that the "no antimicrobials used" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories II to IV and avilamycin).

Figure 2. 5 Percentage of broiler flocks reporting antimicrobials used in feed by province/region, 2014 to 2018



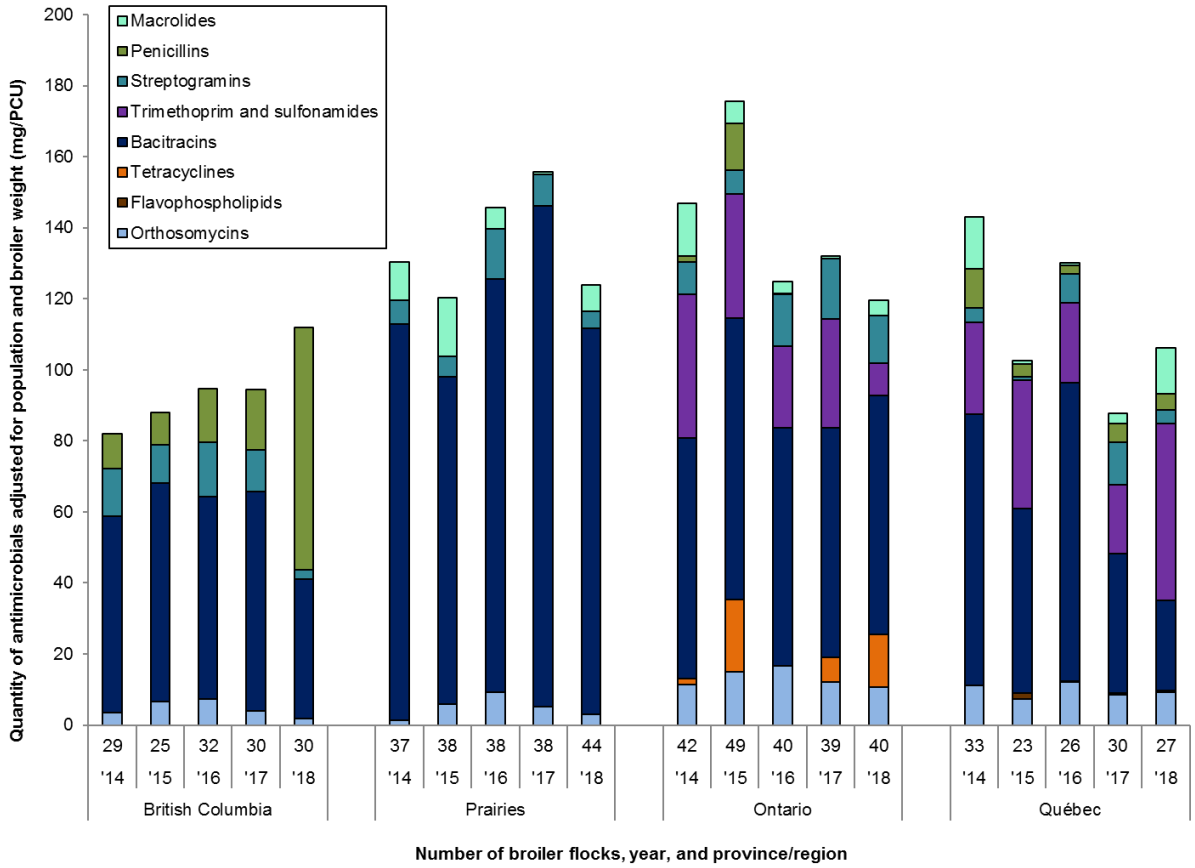
Number of broiler flocks, year and province/region

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

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).
Numbers per column may not add up to 100% as some flocks may have used an antimicrobial more than once or used multiple antimicrobials throughout the grow-out period.
For the temporal analyses within province/region, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province/region ($P \leq 0.05$) for a given antimicrobial. The presence of red areas indicates significant provincial/regional differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given antimicrobial.
Please note that the "no antimicrobials used" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories II to IV and avilamycin), some flocks have used coccidiostats; previous years' data were updated.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Antimicrobials use in feed by quantitative indicators

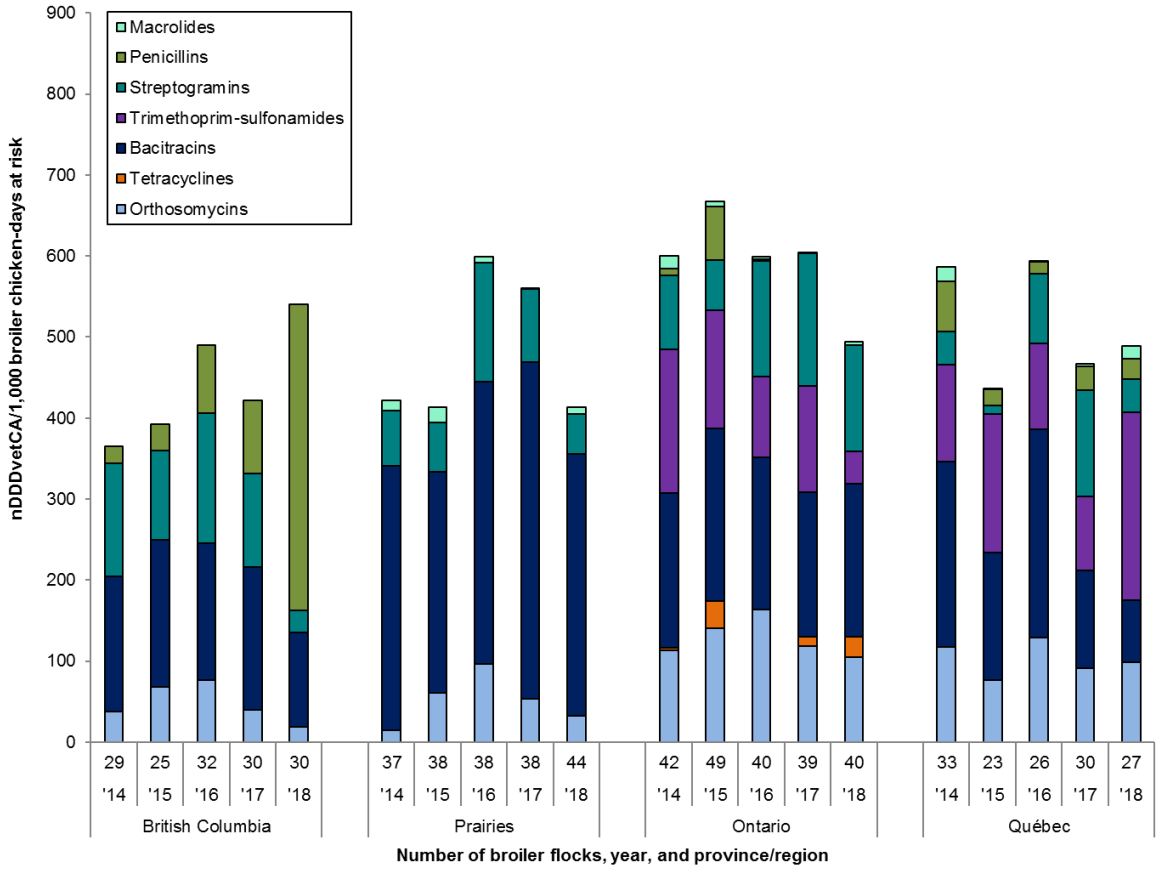
Figure 2. 6 Quantity of antimicrobials used in feed adjusted for population and broiler weight (mg/PCU), 2014 to 2018



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

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).
mg/PCU = milligrams/population correction unit.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 2. 7 Number of Canadian Defined Daily Doses for animals per 1,000 broiler chicken-days at risk (nDDDvetCA/1,000 broiler chicken-days at risk) for antimicrobials administered in feed, 2014 to 2018

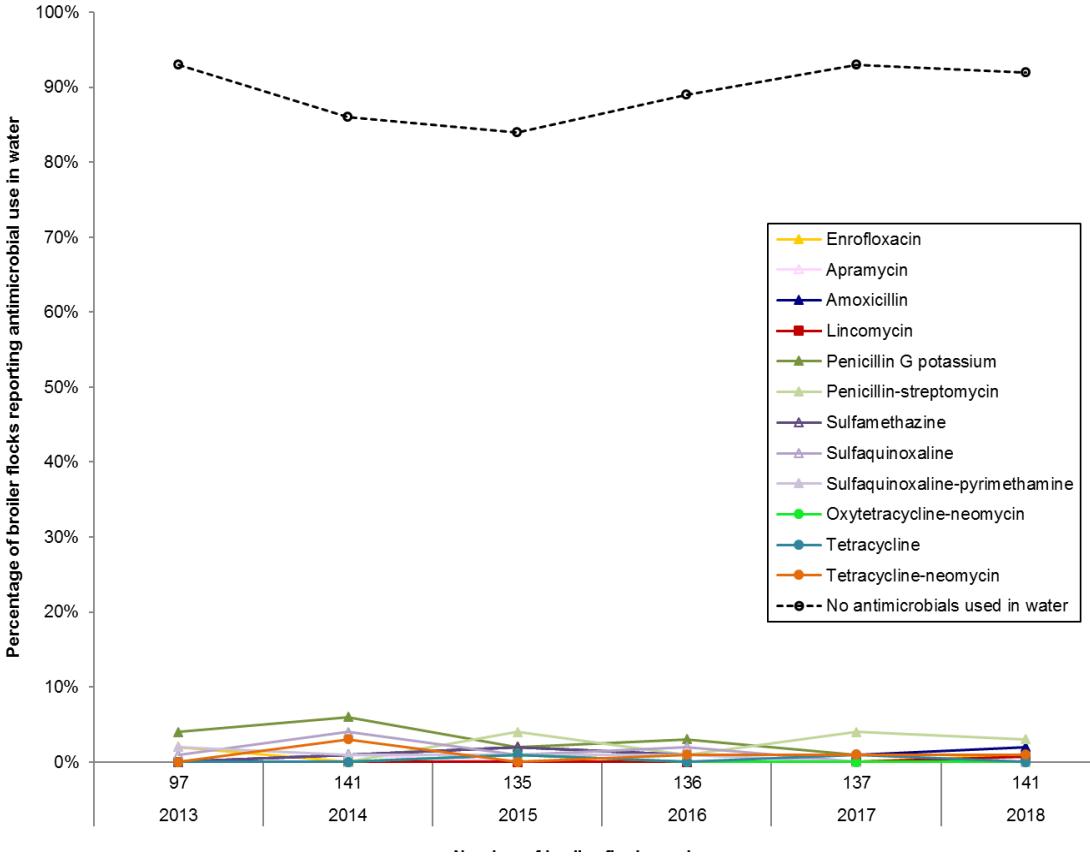


Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Antimicrobial class																					
II	Macrolides	0	0	0	0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

Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification 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.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Antimicrobial use in water by frequency

Figure 2. 8 Percentage of broiler flocks reporting antimicrobial use in water, 2013 to 2018



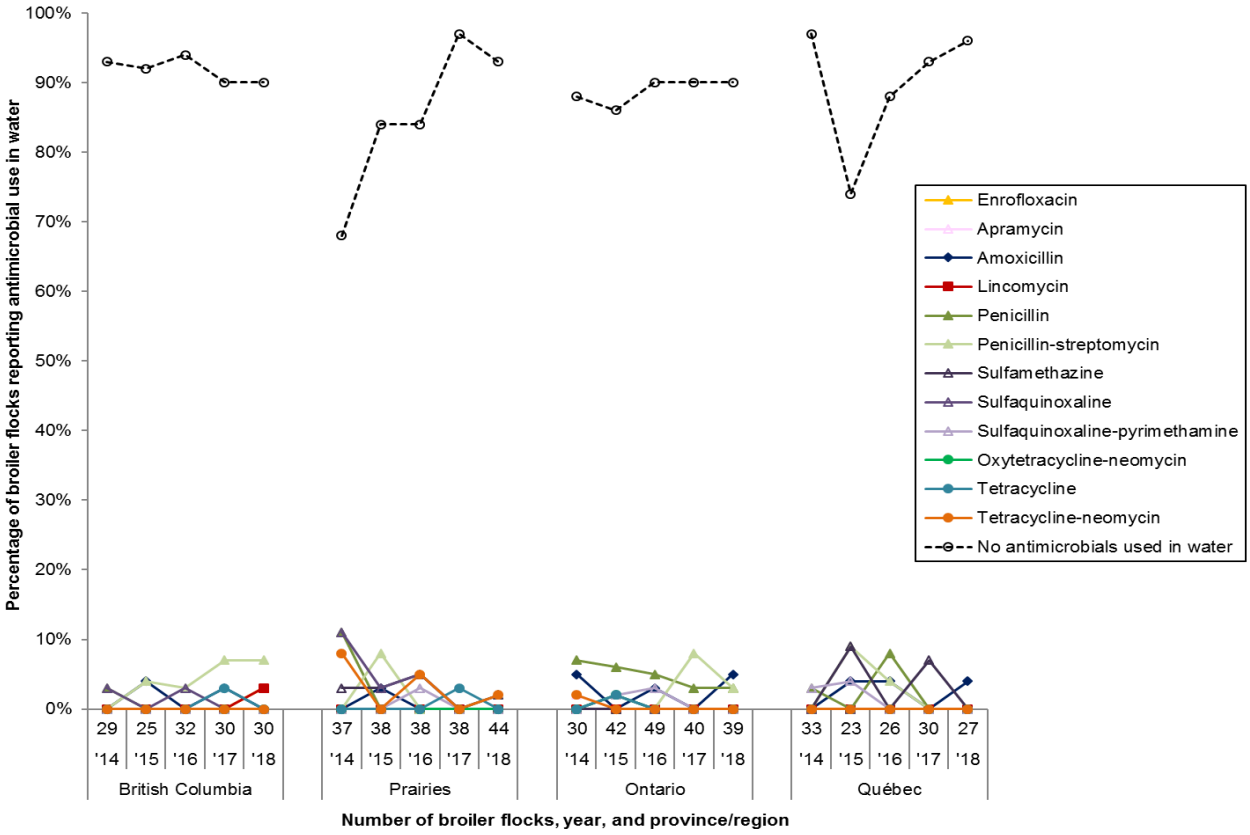
Year Number of flocks	2013 97	2014 141	2015 135	2016 136	2017 137	2018 141
Antimicrobial						
I Enrofloxacin	**2%**	0%	0%	0%	**0%**	**1%**
Apramycin	**0%**	1%	0%	0%	**0%**	**0%**
Amoxicillin	**0%**	1%	2%	1%	**1%**	**2%**
II Lincomycin	**0%**	0%	0%	0%	**0%**	**1%**
Penicillin G potassium	**4%**	6%	2%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

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

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

For the temporal analysis, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in 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. 9 Percentage of broiler flocks reporting antimicrobial use in water, 2014 to 2018



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

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

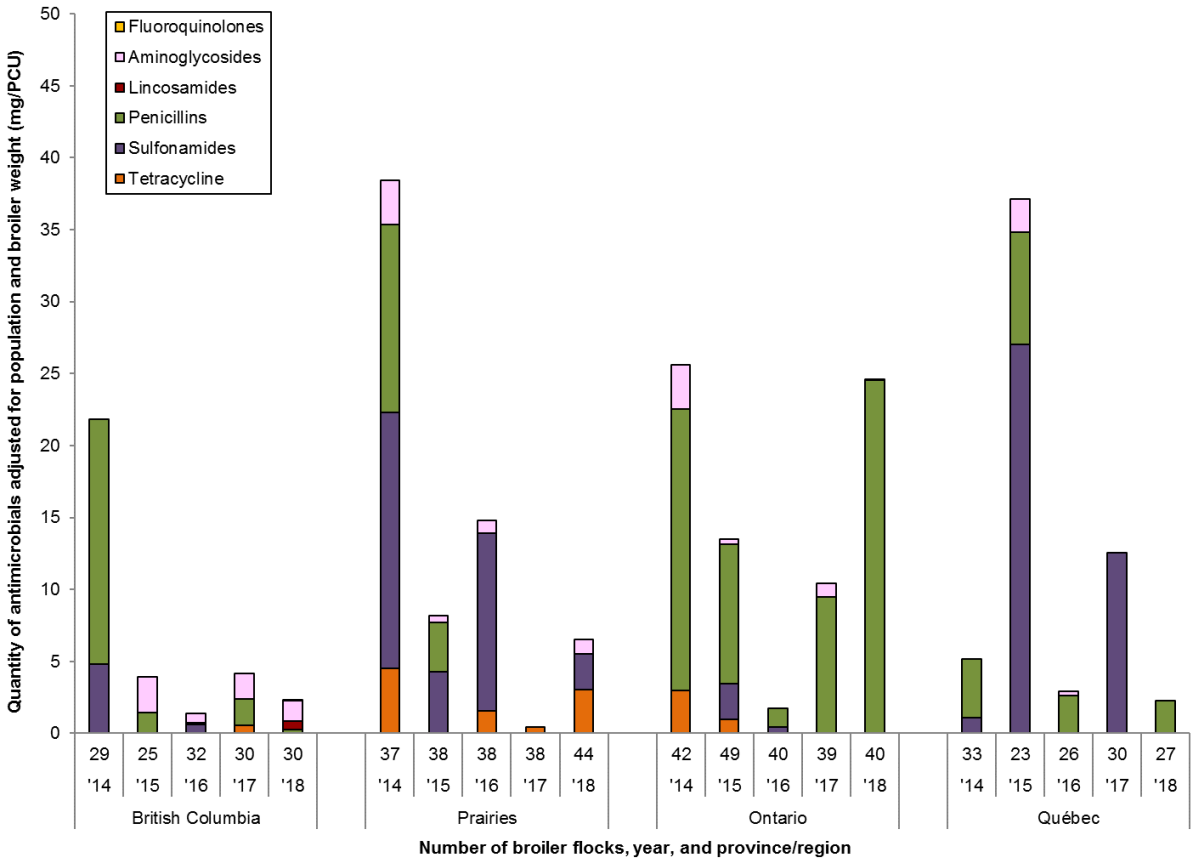
Numbers per column may not add up to 100% as some flocks may have used an antimicrobial more than once or used multiple antimicrobials throughout the grow-out period.

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

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

Antimicrobials use in water by quantitative indicators

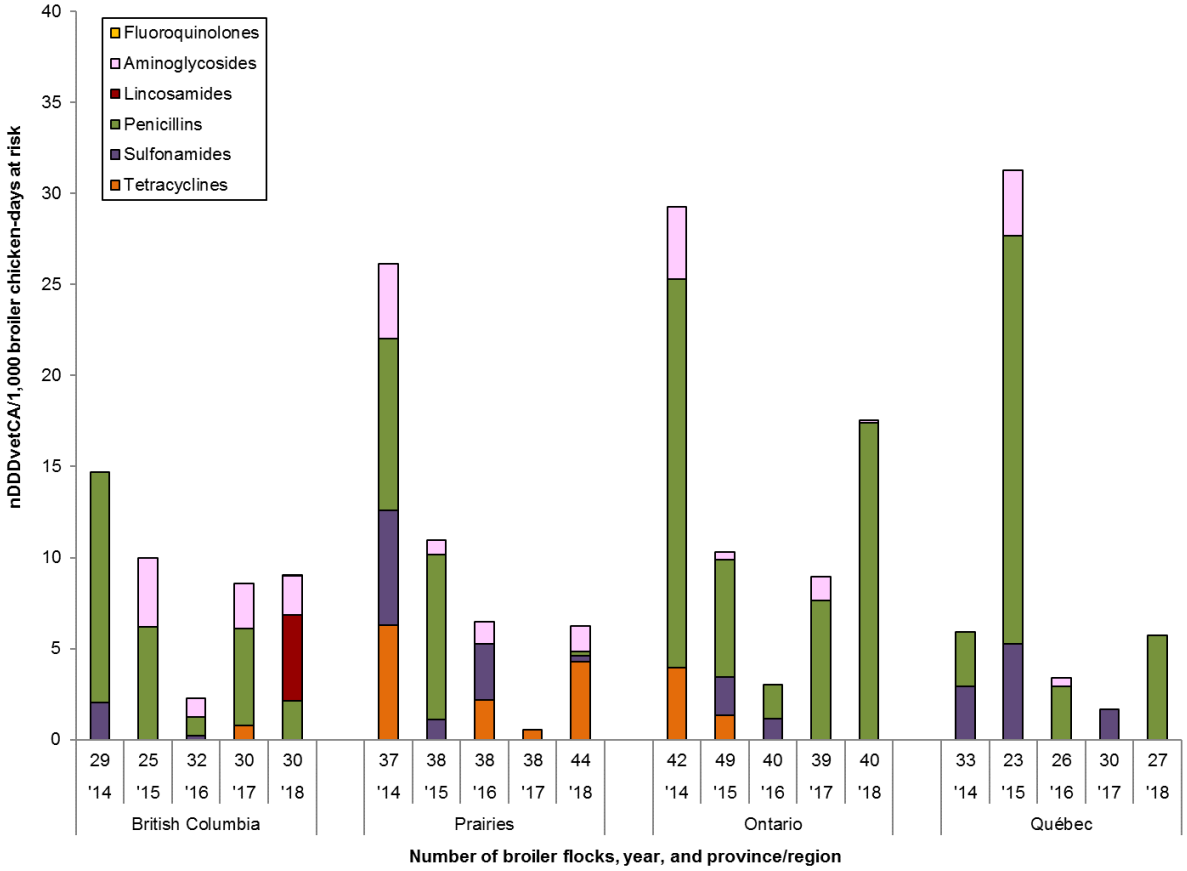
Figure 2. 10 Quantity of antimicrobials used in water adjusted for population and broiler weight (mg/PCU), 2014 to 2018



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

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).
mg/PCU = milligrams/population correction unit.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 2. 11 Number of Canadian Defined Daily Doses for animals per 1,000 broiler chicken-days at risk (nDDDvetCA/1,000 broiler chicken-days at risk) for antimicrobials administered in water, 2014 to 2018

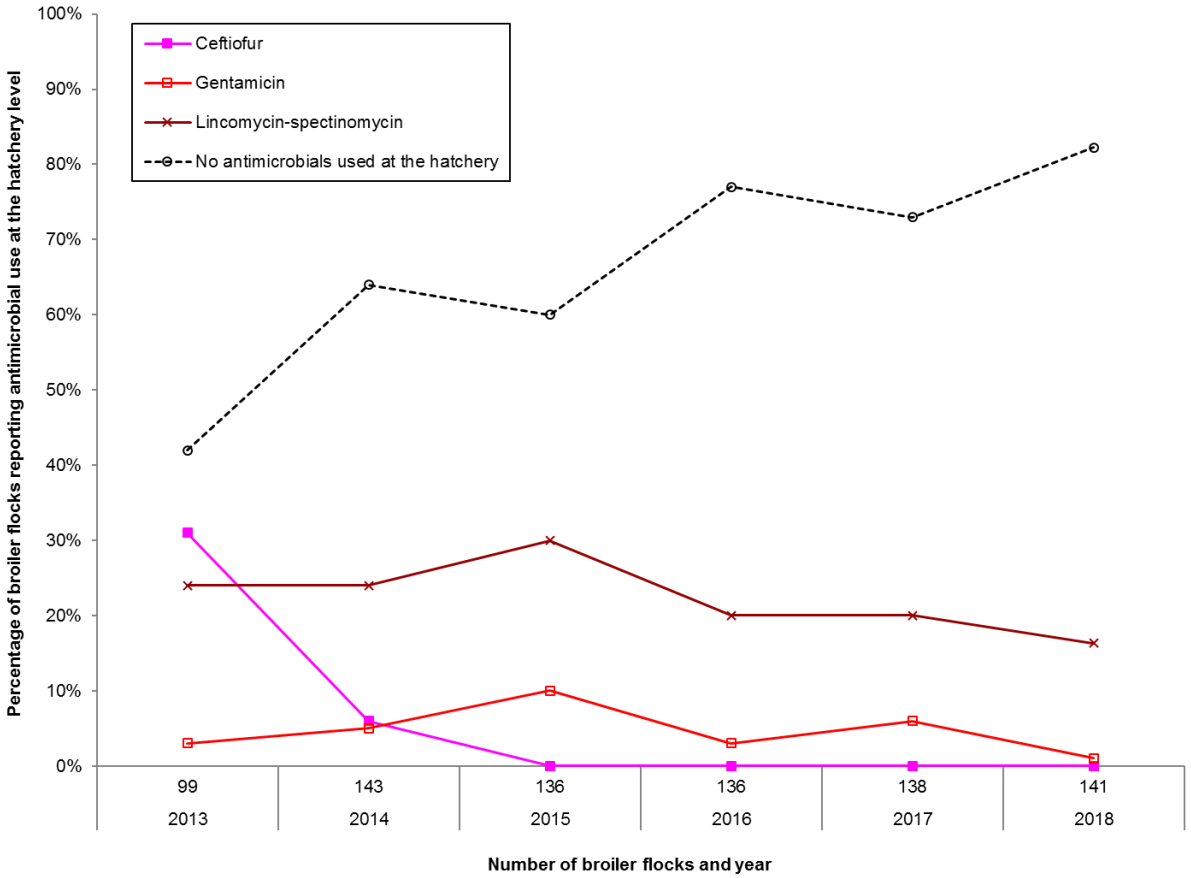


Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Antimicrobial class																					
I	Fluoroquinolones	0	0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

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of 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.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Antimicrobial use *in ovo* or subcutaneous injection by frequency

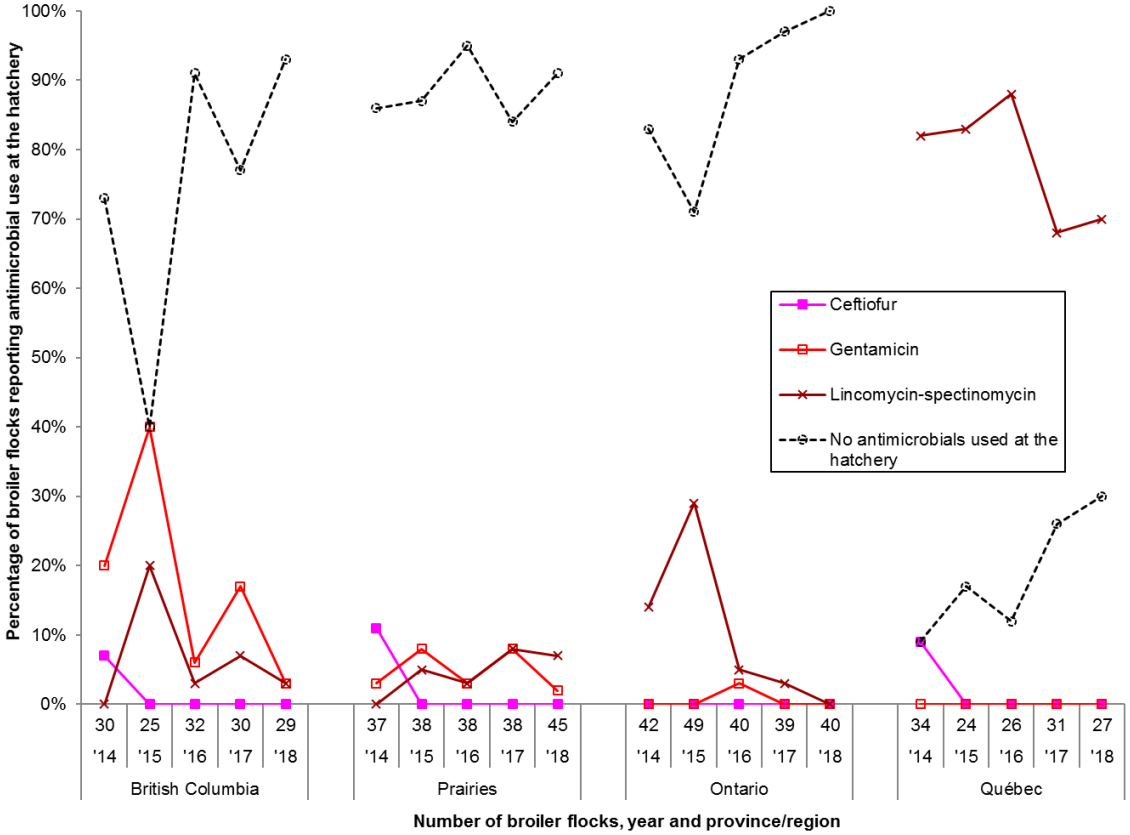
Figure 2. 12 Percentage of broiler flocks reporting antimicrobial use *in ovo* or subcutaneous injection at the hatchery level, 2013 to 2018



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

Roman numerals I to II indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Numbers per column may not add up to 100% due to rounding or batches of chicks (hatched at the same time to supply 1 barn) may have used more than one antimicrobial.
Data represent flocks medicated at the hatchery at day 18 of incubation or upon hatch.
For the temporal analyses, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in the first and previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.

Figure 2. 13 Percentage of broiler flocks reporting antimicrobial use *in ovo* or subcutaneous injection at the hatchery level by province/region, 2014 to 2018



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

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

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

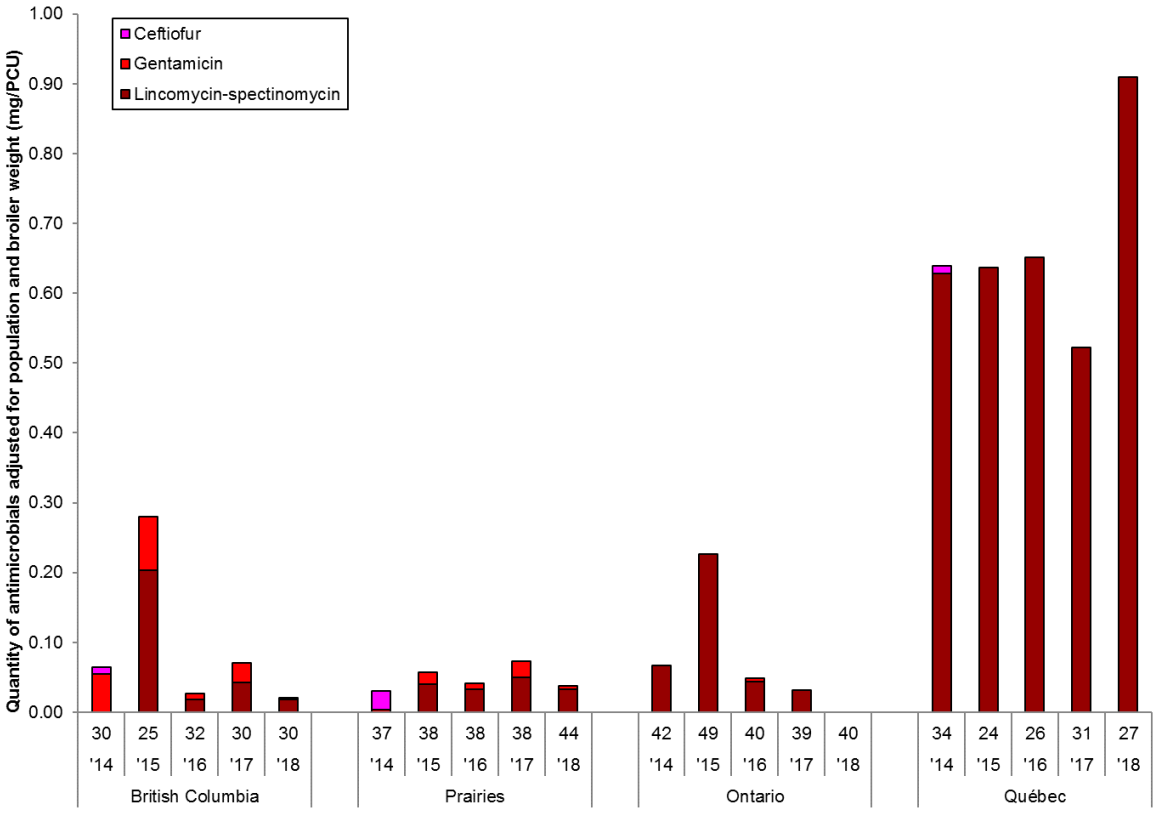
Data represent flocks medicated at the hatchery at day 18 of incubation or upon hatch.

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

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

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

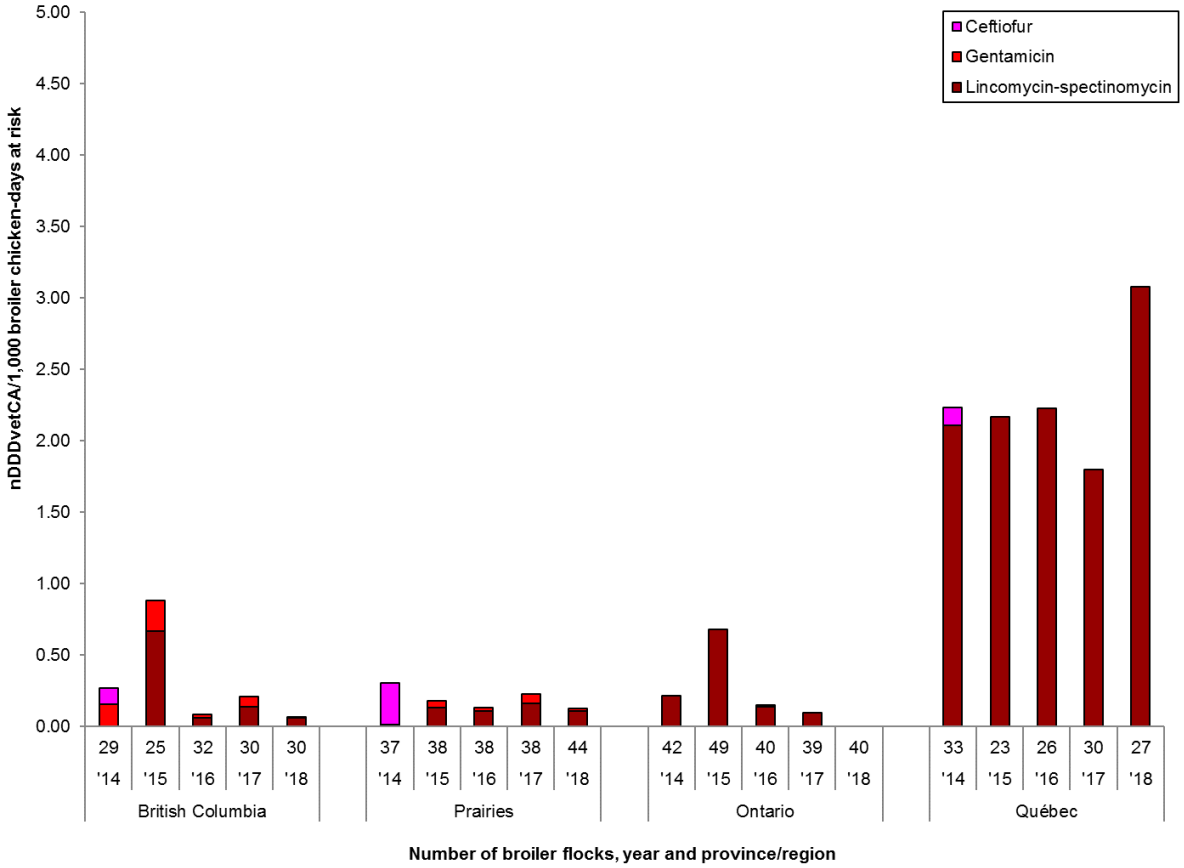
Figure 2. 14 Quantity of antimicrobial use *in ovo* or subcutaneous injection, adjusted for population and broiler weight (mg/PCU), 2014 to 2018



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

Roman numerals I to II indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Total milligrams active ingredient was calculated using the final dose (in milligrams per hatching egg or chick) suggested by the manufacturer and expert opinion based on milligrams per body weight or residue avoidance information.
mg/PCU = milligrams/population correction unit
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Figure 2. 15 Number of Canadian Defined Daily Doses for animals per 1,000 broiler chicken-days at risk (nDDDvetCA/1,000 chicken-days) for antimicrobials administered *in ovo* or subcutaneous injection, 2014 to 2018

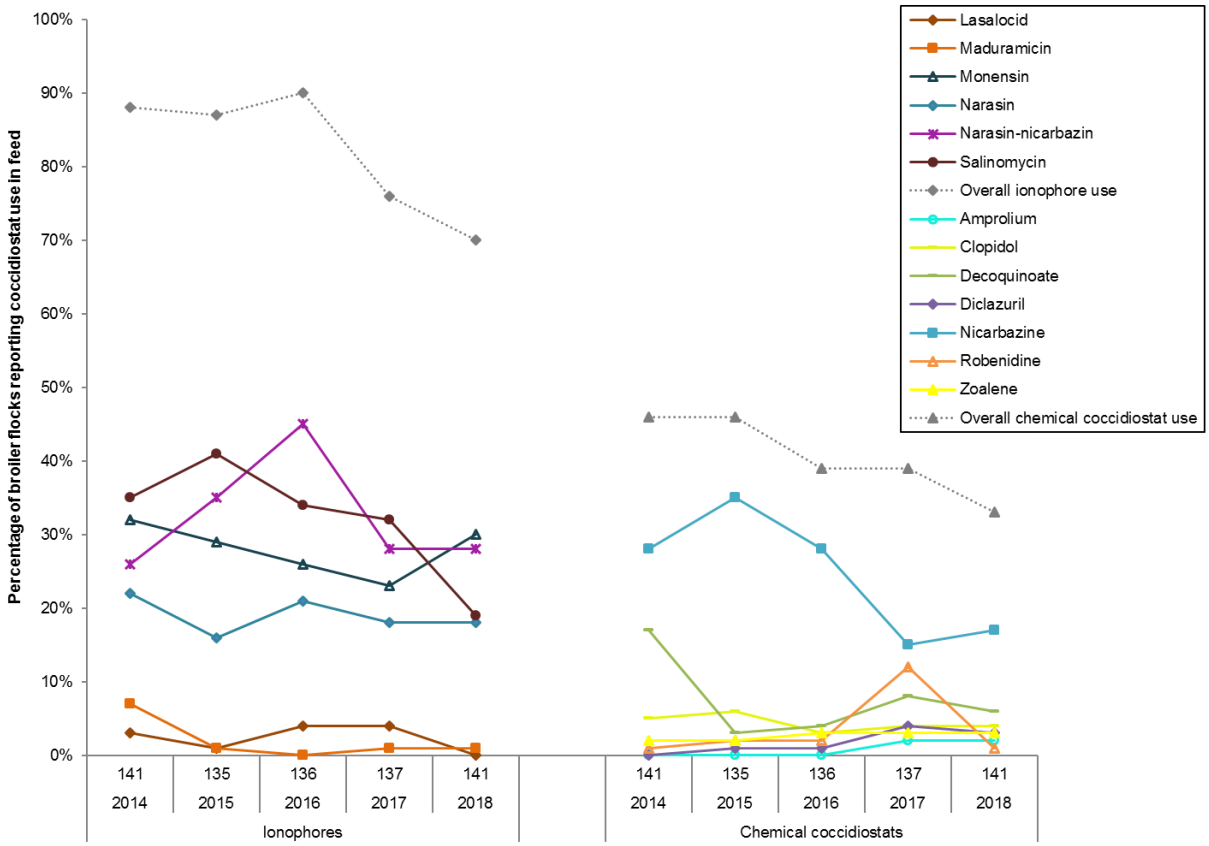


Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Antimicrobial																					
I	Ceftiofur	0.11	0	0	0	0	0.30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

Roman numerals I to II indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligram per kilogram broiler weight per day (mg_{drug}/kg_{animal}/day); please refer to Appendix: Supplemental data of the 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.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Coccidiostat use in feed by frequency

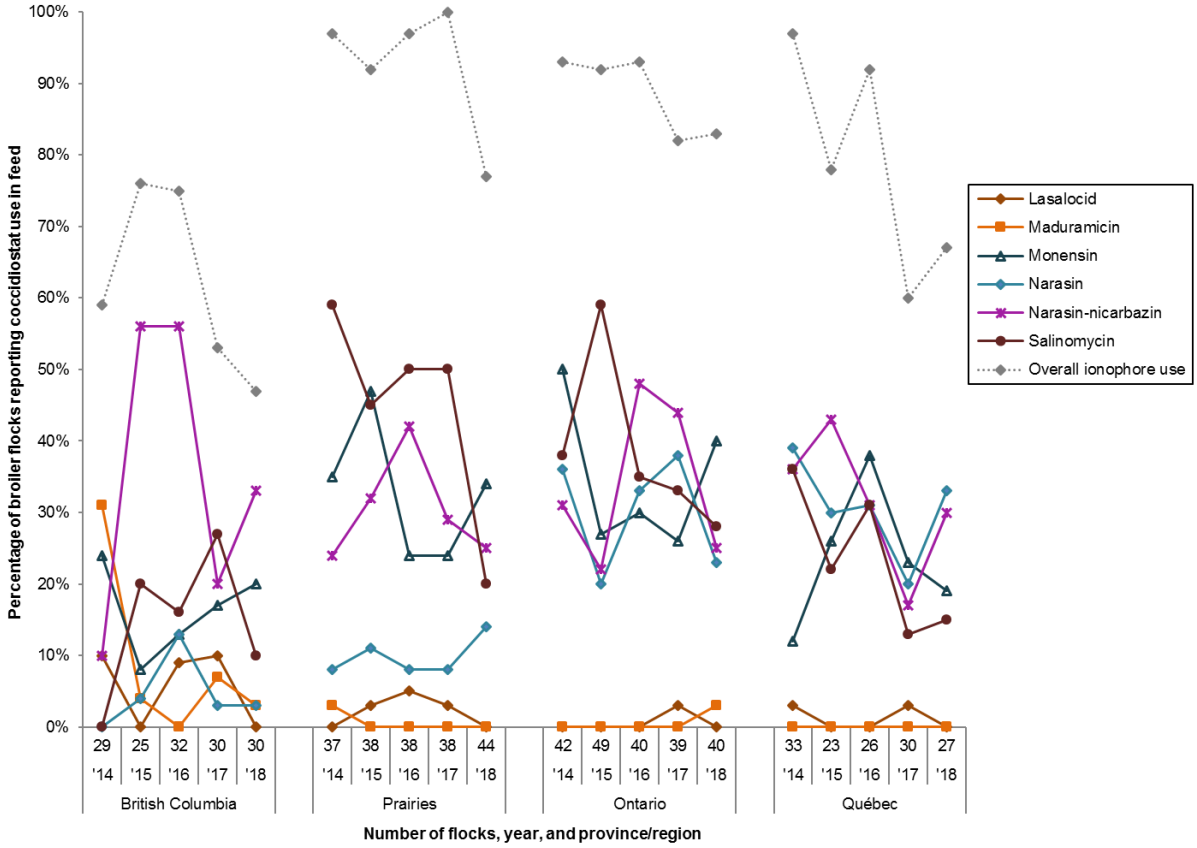
Figure 2. 16 Percentage of broiler flocks reporting coccidiostat use in feed, 2014 to 2018



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

Roman numeral IV indicate 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. 17 Percentage of broiler flocks reporting ionophore coccidiostats in feed, by province/region, 2014 to 2018



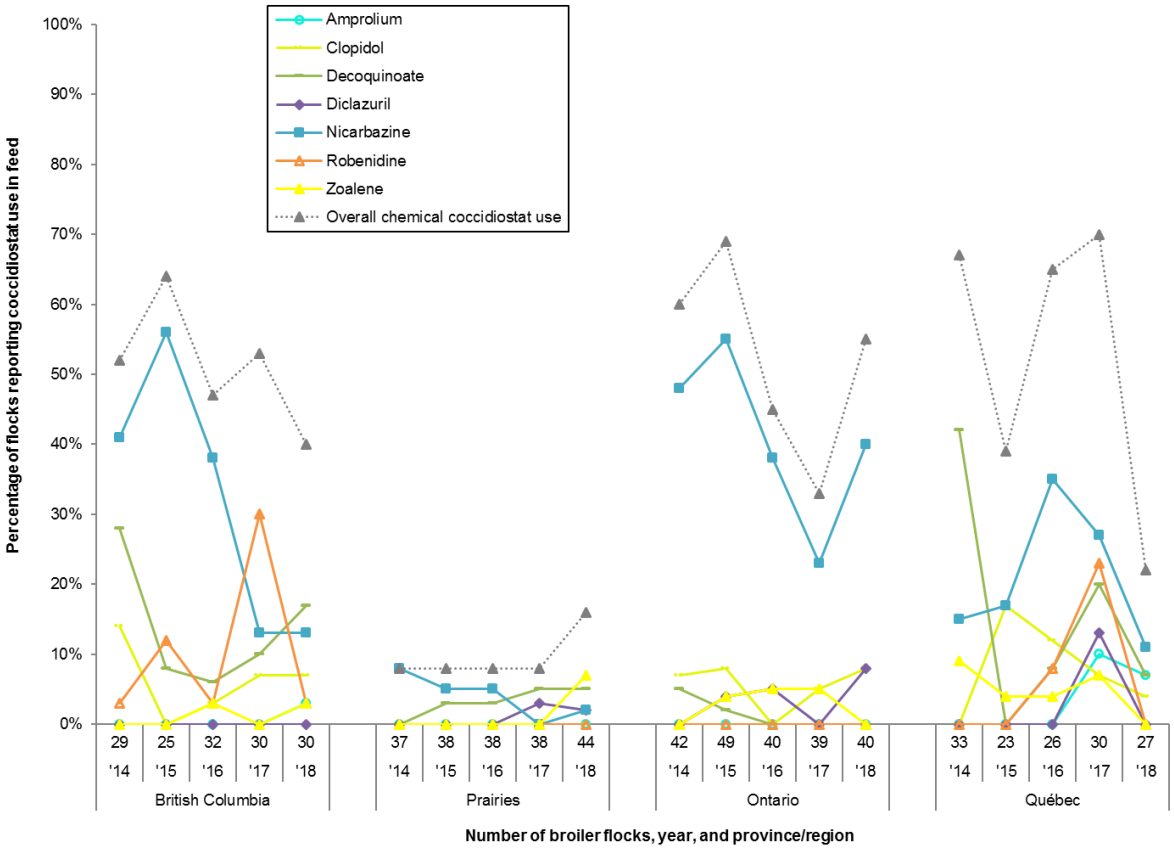
Province/region		British Columbia					Prairies					Ontario					Québec				
Year		'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of flocks		29	25	32	30	30	37	38	38	38	44	42	49	40	39	40	33	23	26	30	27
Coccidiostat																					
IV	Lasalocid	**10%**	0%	9%	**10%**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

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

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

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

Figure 2. 18 Percentage of broiler flocks reporting chemical coccidiostat in feed, by province/region, 2014 to 2018



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

N/A = not applicable (no classification at the time of writing of this report).
For the temporal analyses within province/region, the proportion (%) of flocks using a specific chemical coccidiostat in the current year has been compared to the proportion (%) of flocks using the same chemical coccidiostat in the first and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province/region ($P \leq 0.05$) for a given chemical coccidiostat. The presence of red areas indicates significant provincial/regional differences ($P \leq 0.05$) for a given chemical coccidiostat within the current year (Québec-referent province). The presence of purple areas (2018 surveillance year; Québec-referent province) indicates significant temporal and provincial/regional differences ($P \leq 0.05$) for a given chemical coccidiostat.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Chapter 3 Antimicrobial resistance

Broiler chickens

Data pertains to pre-harvest sampling. In 2018, the chick placement component of the farm program was discontinued.

Key findings

Salmonella

- When data from all provinces were combined, the top 3 *Salmonella* serovars were Kentucky, Enteriditis, and Heidelberg. For 3 consecutive years, Enteritidis was detected in all provinces/regions sampled (Table 3. 1) and was the top serovar detected in the Prairies and in Ontario. Overall, ceftriaxone resistance increased by 9% from the previous year and the increase was observed in all provinces/regions sampled (Figure 3. 1).
- There were 9 nalidixic acid resistant Kentucky and 1 Enteritidis that exhibited resistance to 4 antimicrobials recovered from British Columbia (Table 3. 1).

Escherichia coli

- At pre-harvest, overall there were 2 isolates resistant to ciprofloxacin (less than 1%) and 30 isolates resistant to nalidixic acid (5%) recovered from British Columbia. Between 2017 and 2018, resistance to ceftriaxone (decreased by 3%) and gentamicin (no change) was relatively stable (Figure 3. 2).
- No meropenem resistance observed among the isolates.

Campylobacter

- Between 2017 and 2018, ciprofloxacin resistance decreased from 36% to 17% in British Columbia. Resistant isolates (8 of the 16 total isolates recovered) were detected in Québec (Figure 3. 3).

Multiclass resistance

Table 3. 1 Number of antimicrobial classes in resistance patterns of *Salmonella* from broiler chickens at pre-harvest, 2018

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

Antimicrobial abbreviations are defined in the Appendix.
Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Table 3. 2 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from chickens at pre-harvest, 2018

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

Antimicrobial abbreviations are defined in the Appendix.
Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

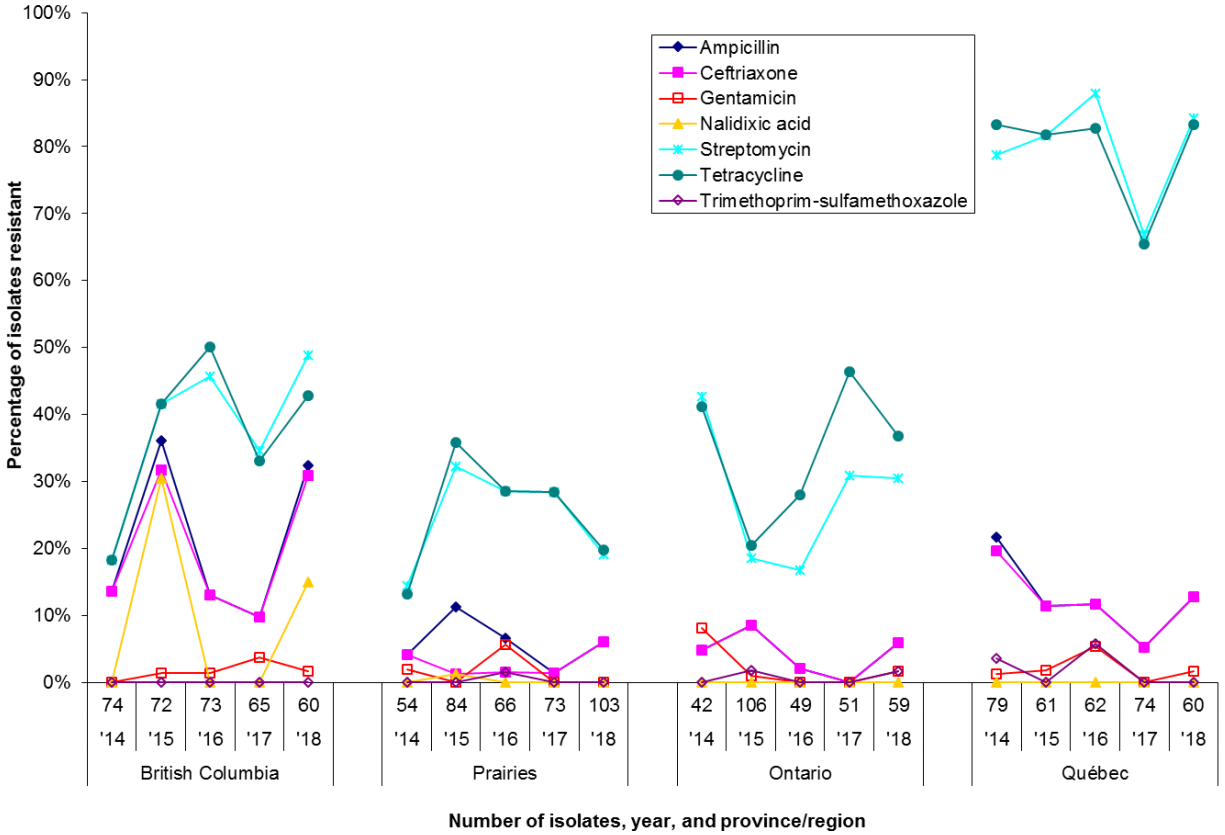
Table 3. 3 Number of antimicrobial classes in resistance patterns of *Campylobacter* from chickens at pre-harvest, 2018

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

Antimicrobial abbreviations are defined in the Appendix.
Red, blue, and black numbers indicate isolates resistant to antimicrobials in Categories I, II, and III of importance to human medicine, respectively.
The Prairies is a region including the provinces of Alberta and Saskatchewan.

Temporal antimicrobial resistance summary

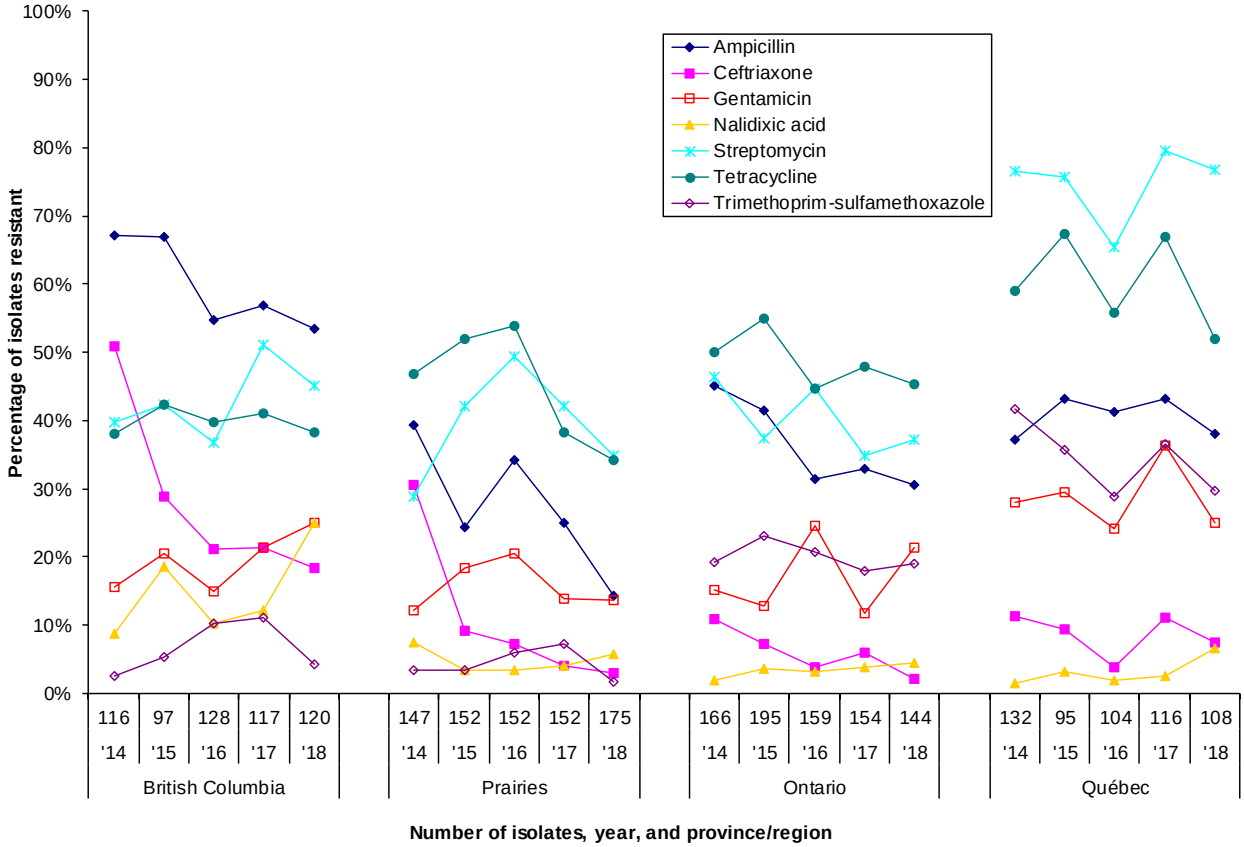
Figure 3. 1 Temporal variations in resistance of *Salmonella* isolates from chickens at pre-harvest, 2014 to 2018



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	74	72	73	65	60	54	84	66	73	103	42	106	49	51	59	79	61	62	74	60
Antimicrobial																				
Ampicillin	**14%**	36%	13%	**10%**	**32%**	**4%**	11%	7%	**1%**	**6%**	**5%**	8%	2%	**0%**	**6%**	**22%**	11%	12%	**5%**	**13%**
Ceftriaxone	**14%**	32%	13%	**10%**	**31%**	**4%**	1%	2%	**1%**	**6%**	**5%**	8%	2%	**0%**	**6%**	**20%**	11%	12%	**5%**	**13%**
Gentamicin	**0%**	1%	1%	**4%**	**2%**	**2%**	0%	6%	**0%**	**0%**	**8%**	1%	0%	**0%**	**2%**	**1%**	2%	5%	**0%**	**2%**
Nalidixic acid	**0%**	30%	0%	**0%**	**15%**	**0%**	1%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
Streptomycin	**18%**	42%	46%	**35%**	**49%**	**14%**	32%	28%	**28%**	**19%**	**43%**	18%	17%	**31%**	**30%**	**79%**	82%	88%	**67%**	**84%**
Tetracycline	**18%**	42%	50%	**33%**	**43%**	**13%**	36%	28%	**28%**	**20%**	**41%**	20%	28%	**46%**	**37%**	**83%**	82%	83%	**65%**	**83%**
sulfamethoxazole	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	2%	**0%**	**0%**	**0%**	2%	0%	**0%**	**2%**	**4%**	0%	6%	**0%**	**0%**

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

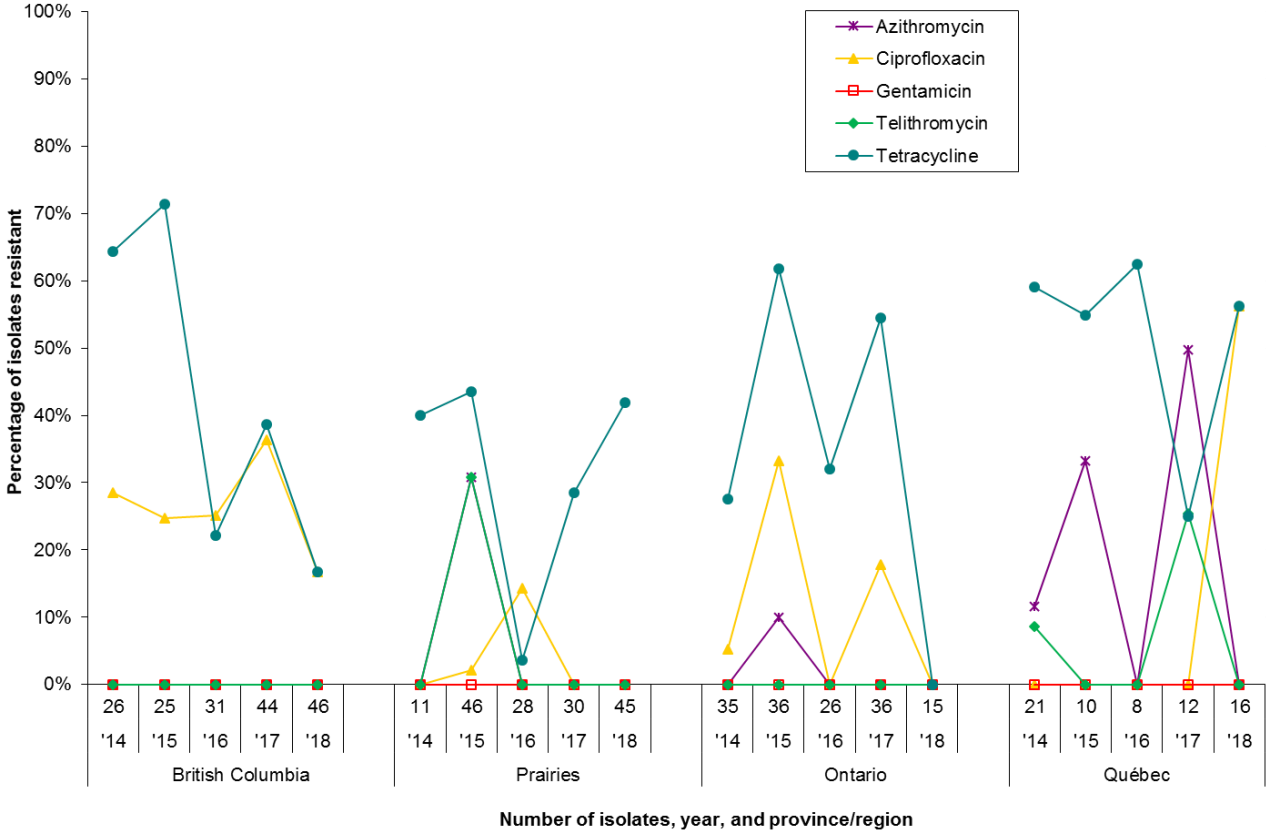
Figure 3. 2 Temporal variations in resistance of *Escherichia coli* isolates from chickens at pre-harvest, 2014 to 2018



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	116	97	128	117	120	147	152	152	152	175	166	195	159	154	144	132	95	104	116	108
Antimicrobial																				
Ampicillin	**67%**	67%	55%	**57%**	**53%**	**39%**	24%	34%	**25%**	**14%**	**45%**	41%	31%	**33%**	**31%**	**37%**	43%	41%	**43%**	**38%**
Ceftriaxone	**51%**	29%	21%	**21%**	**18%**	**31%**	9%	7%	**4%**	**3%**	**11%**	7%	4%	**6%**	**2%**	**11%**	9%	4%	**11%**	**7%**
Gentamicin	**16%**	21%	15%	**21%**	**25%**	**12%**	18%	20%	**14%**	**14%**	**15%**	13%	25%	**12%**	**21%**	**28%**	29%	24%	**36%**	**25%**
Nalidixic acid	**9%**	19%	10%	**12%**	**25%**	**7%**	3%	3%	**4%**	**6%**	**2%**	4%	3%	**4%**	**4%**	**2%**	3%	2%	**3%**	**6%**
Streptomycin	**40%**	42%	37%	**51%**	**45%**	**29%**	42%	49%	**42%**	**35%**	**46%**	37%	45%	**35%**	**37%**	**77%**	76%	65%	**79%**	**77%**
Tetracycline	**38%**	42%	40%	**41%**	**38%**	**47%**	52%	54%	**38%**	**34%**	**50%**	55%	45%	**48%**	**45%**	**59%**	67%	56%	**67%**	**52%**
sulfamethoxazole	**3%**	5%	10%	**11%**	**4%**	**3%**	3%	6%	**7%**	**2%**	**19%**	23%	21%	**18%**	**19%**	**42%**	36%	29%	**36%**	**30%**

The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock. For the temporal analyses 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. 3 Temporal variations in resistance of *Campylobacter* isolates from chickens at pre-harvest, 2014 to 2018



Province/region	British Columbia					Prairies					Ontario					Québec				
Year	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18	'14	'15	'16	'17	'18
Number of isolates	26	25	31	44	46	11	46	28	30	45	35	36	26	36	15	21	10	8	12	16
Antimicrobial																				
Azithromycin	**0%**	0%	0%	**0%**	**0%**	0%	31%	0%	**0%**	**0%**	**0%**	10%	0%	**0%**	**0%**	**12%**	33%	0%	**50%**	**0%**
Ciprofloxacin	**29%**	25%	25%	**36%**	**17%**	0%	2%	14%	**0%**	**0%**	**5%**	33%	0%	**18%**	**0%**	**0%**	0%	0%	**0%**	**56%**
Gentamicin	**0%**	0%	0%	**0%**	**0%**	0%	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**
Telithromycin	**0%**	0%	0%	**0%**	**0%**	0%	31%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**0%**	**9%**	0%	0%	**25%**	**0%**
Tetracycline	**64%**	71%	22%	**39%**	**17%**	40%	44%	4%	**29%**	**42%**	**28%**	62%	32%	**55%**	**0%**	**59%**	55%	63%	**25%**	**56%**

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

Recovery results

Table 3. 4 Farm surveillance recovery rates in broiler chickens, 2013 to 2018

CIPARS Component / Animal species	Province / region	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted							
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*	
Chickens (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				
		2018								
	Prairies	2013	**89%**	31/35	**29%**	10/35				
		2014	**82%**	46/56	**13%**	7/56				
		2015	**80%**	44/55	**20%**	11/55				
		2016	**73%**	40/55	**15%**	8/55				
		2017	**87%**	48/55	**22%**	12/55				
		2018								
	Ontario	2013	**85%**	64/75	**17%**	13/75				
		2014	**87%**	65/75	**3%**	2/75				
		2015	**88%**	66/75	**9%**	7/75				
		2016	**93%**	70/75	**3%**	2/75				
		2017	**87%**	65/75	**8%**	6/75				
		2018								
	Québec	2013	**82%**	53/65	**17%**	11/65				
		2014	**83%**	66/80	**11%**	9/80				
		2015	**87%**	39/45	**27%**	12/45				
		2016	**74%**	52/70	**21%**	15/70				
		2017	**76%**	65/85	**18%**	15/85				
		2018								
	National	2013	**81%**	191/235	**22%**	51/235				
		2014	**80%**	234/291	**12%**	36/291				
		2015	**83%**	186/225	**17%**	38/225				
		2016	**77%**	220/285	**12%**	35/285				
		2017	**83%**	237/285	**19%**	54/285				
		2018								
Chickens (Pre-harvest)	British Columbia	2013	**98%**	94/96	**71%**	68/96	**28%**	27/96		
		2014	**100%**	116/116	**64%**	74/116	**22%**	26/116		
		2015	**97%**	97/100	**72%**	72/100	**25%**	25/100		
		2016	**100%**	128/128	**57%**	73/128	**24%**	31/128		
		2017	**98%**	117/120	**54%**	65/120	**37%**	44/120		
		2018	**100%**	120/120	**50%**	60/120	**38%**	46/120		
	Prairies	2013	**100%**	60/60	**40%**	24/60	**25%**	15/60		
		2014	**99%**	147/148	**36%**	54/148	**7%**	11/148		
		2015	**100%**	152/152	**55%**	84/152	**30%**	46/152		
		2016	**100%**	152/152	**43%**	66/152	**18%**	28/152		
		2017	**100%**	152/152	**48%**	73/152	**20%**	30/152		
		2018	**99%**	175/176	**59%**	103/176	**26%**	45/176		
	Ontario	2013	**100%**	120/120	**54%**	65/120	**17%**	20/120		
		2014	**99%**	166/168	**25%**	42/168	**21%**	35/168		
		2015	**99%**	195/196	**54%**	106/196	**18%**	36/196		
		2016	**99%**	159/160	**31%**	49/160	**16%**	26/160		
		2017	**99%**	154/156	**33%**	51/156	**23%**	36/156		
		2018	**92%**	144/156	**38%**	59/156	**10%**	15/156		
	Québec	2013	**99%**	111/112	**64%**	72/112	**17%**	19/112		
		2014	**100%**	132/132	**60%**	79/132	**16%**	21/132		
		2015	**99%**	95/96	**64%**	61/96	**10%**	10/96		
		2016	**100%**	104/104	**61%**	63/104	**8%**	8/104		
		2017	**97%**	116/120	**62%**	74/120	**10%**	12/120		
		2018	**100%**	108/108	**56%**	60/108	**15%**	16/108		
	National	2013	**99%**	385/388	**59%**	229/388	**20%**	81/388		
		2014	**99%**	561/564	**44%**	249/564	**16%**	93/564		
		2015	**99%**	539/544	**59%**	323/544	**22%**	117/544		
		2016	**99%**	543/544	**46%**	251/544	**17%**	93/544		
		2017	**98%**	539/548	**48%**	263/548	**22%**	122/548		
		2018	**98%**	547/560	**50%**	282/560	**22%**	122/560		

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

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[3]

Prairies: AB, SK, MB
Maritimes: NB, NS, PE
Atlantic: 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

[3] In 2018, not all provinces are represented in each surveillance component for the Prairies and the Atlantic region.