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Canada

2019

CIPARS

Canadian Integrated Program for Antimicrobial Resistance Surveillance

Turkey

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

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

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Turkeys

Table of Contents

List of Figures, Tables, and textboxes

List of figures

List of tables

List of textboxes

Acknowledgements

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- Turkey Farmers of Canada
- British Columbia Turkey Farmers
- Turkey Farmers of Ontario
- Les Éleveurs de volailles du Québec
- Canadian Hatcheries Federation
- Canadian Poultry and Egg Processors Council

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 turkeys. These are relevant to antimicrobial use and antimicrobial resistance.

Key findings

Mortality, barn-level percentages by production type

- The median barn-level mortality in the turkey flocks surveyed decreased by 1% in 2019 compared to 6% in 2018 (range: 0.6 to 22%). The percentage of barn mortality varied by production type:
    - Antibiotic free program or raised without antibiotics-mainstream programs (ABF/RWA)[1] (n = 13 flocks; 5% median; range: 3 to 10%).
    - Organic (1 flock, 6%).
    - Conventional (n = 78; 6%; 1 to 22%).
    - Other categories such as flocks raised according to CFIA's updated methods of production claim definitions for RWA/ABF[2] (n = 6; 5%; 1 to 8%).

Turkey poult sources

- Overall, 63% of poults placed in 2019 were domestically sourced (hatchery located in the province were the birds are raised), with 18% of birds reportedly sourced from other provinces (other than the province where the birds are raised) and 20% of poults were imported from the USA (Figure 1. 1). There were provincial variations in poult origin (sourced domestically, other provinces and internationally) (Figure 1. 2).

Diagnosis of diseases in turkey flocks[3]

- Diseases associated with avian pathogenic *Escherichia coli* (APEC) increased overall between 2018 and 2019: airsacculitis from 13% to 16%, septicemia from 17% to 24% and yolksacculitis from 19% to 22%.
- The diagnosis of necrotic enteritis remained stable and flocks diagnosed with coccidiosis increased from 12% to 22%. Other bacterial diseases reported were pneumonia and sinusitis caused by *Ornithobacterium rhinotracheale*, and salmonellosis. Other viral disease diagnosed was bluecomb enteritis, a Turkey Coronavirus Infection (TCoV).

Biosecurity

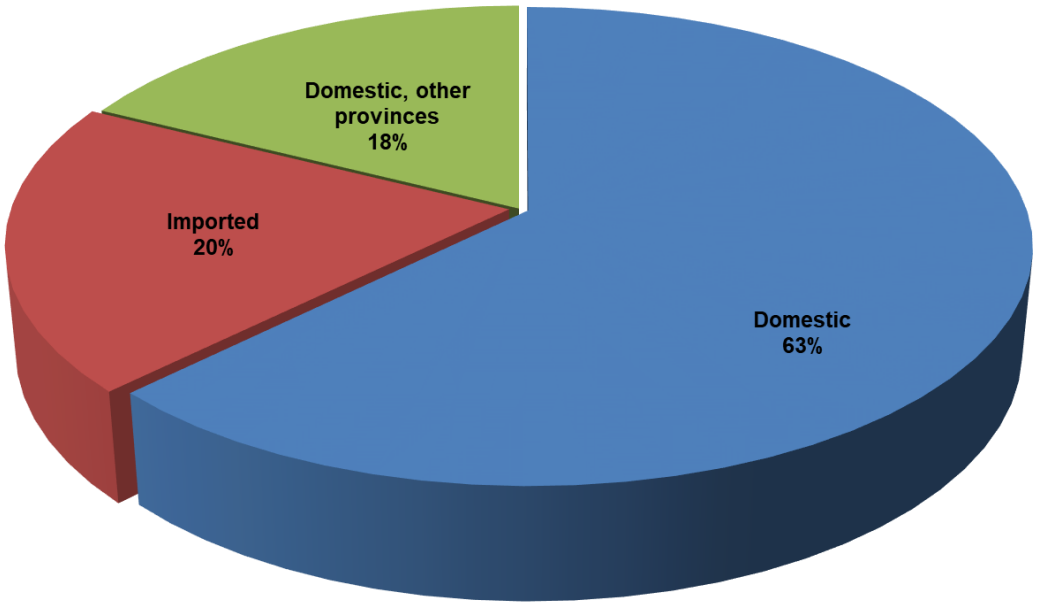
- As for biosecurity practices, producers implemented a mean downtime/rest period between flock cycles of 27 days (range: 0 to 240 days).

[1] Not treated with any antimicrobials including ionophores and chemical coccidostats.
[2] 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 2019.
[3] Please note that all reported diseases were included in the analysis regardless of the diagnostic tool used (any or all of clinical, post mortem and laboratory).

Vaccinations

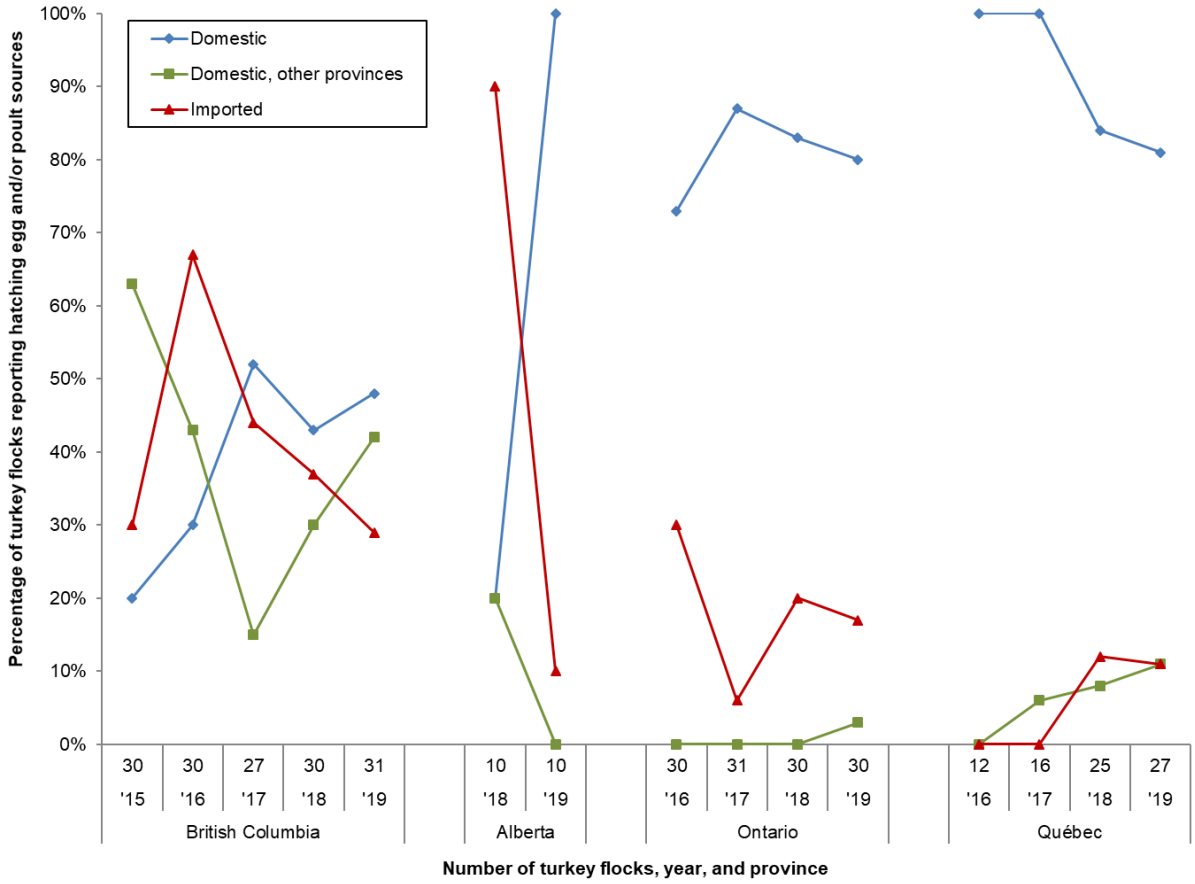
- Fifty percent (49/98 flocks) of producers reported that their flocks were vaccinated with at least 1 viral or bacterial agent. Coccidiosis vaccine was administered to RWA/ABF flocks but decreased from 16% in 2018 to 8% in 2019. Similarly, flocks vaccinated with *E. coli* decreased from 16% in 2018 to 9% in 2019.

Figure 1. 1 Relative distribution of turkey poult sources, 2019



Domestic = hatching eggs originated and/or poults hatched from hatcheries located in the province where the birds were raised.
Domestic, other provinces = hatching eggs originated and/or poults hatched from hatcheries located in provinces other than the province where the birds were raised.
Imported = hatching eggs/poults were sourced by the importing hatchery from the United States or other countries; there were hatching eggs from domestic breeders hatched in United States hatcheries and then delivered/reared in Canadian turkey farms.

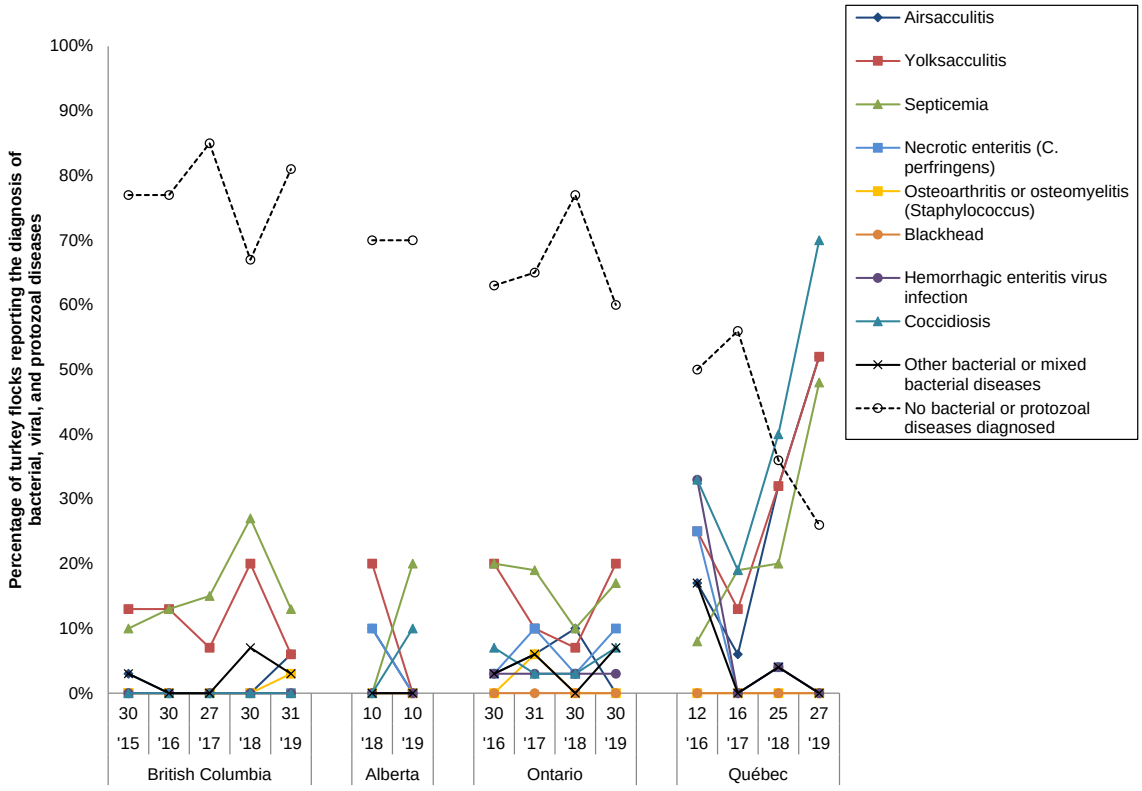
Figure 1. 2 Sources of hatching eggs and/or poults placed in the barn sampled, 2015 to 2019



Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Hatching egg and/or poult sources															
Domestic	20%	30%	52%	43%	48%	20%	100%	73%	87%	83%	80%	100%	100%	84%	81%
Domestic, other provinces	63%	43%	15%	30%	42%	20%	0%	0%	0%	0%	3%	0%	6%	8%	11%
Imported	30%	67%	44%	37%	29%	90%	10%	30%	6%	20%	17%	0%	0%	12%	11%

Domestic = hatching eggs originated and/or poults hatched from hatcheries located in the province where the birds were raised.
Domestic, other provinces = hatching eggs originated and/or poults hatched from hatcheries located in provinces other than the province where the birds were raised.
Imported = hatching eggs/poults were sourced by the importing hatchery from the United States or other countries; there were hatching eggs from domestic breeders hatched in United States hatcheries and then delivered/reared in Canadian turkey farms.

Figure 1. 3 Percentage of turkey flocks reporting bacterial, viral, and protozoal diseases, 2015 to 2019



Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Bacterial, viral, and protozoal diseases															
Airsacculitis	3%	0%	0%	0%	6%	10%	0%	3%	6%	10%	0%	17%	6%	32%	52%
Yolksacculitis	13%	13%	7%	20%	6%	20%	0%	20%	10%	7%	20%	25%	13%	32%	52%
Septicemia	10%	13%	15%	27%	13%	0%	20%	20%	19%	10%	17%	8%	19%	20%	48%
Necrotic enteritis (*C. perfringens*)	0%	0%	0%	0%	0%	10%	0%	3%	10%	3%	10%	25%	0%	4%	0%
Osteoarthritis or osteomyelitis (*Staphylococcus*)	0%	0%	0%	0%	3%	0%	0%	0%	6%	0%	0%	0%	0%	0%	0%
Blackhead	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hemorrhagic enteritis virus infection	0%	0%	0%	0%	0%	0%	0%	3%	3%	3%	3%	33%	0%	4%	0%
Coccidiosis	0%	0%	0%	0%	0%	0%	10%	7%	3%	3%	7%	33%	19%	40%	70%
Other bacterial or mixed bacterial diseases	3%	0%	0%	7%	3%	0%	0%	3%	6%	0%	7%	17%	0%	4%	0%
No bacterial or protozoal diseases diagnosed	77%	77%	85%	67%	81%	70%	70%	63%	65%	77%	60%	50%	56%	36%	26%

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". No diseases diagnosed pertains to flocks reporting "Likely Negative" in all diseases listed on the questionnaire.

In 2019, other bacterial diseases reported were pneumonia and sinusitis caused by *Ornithobacterium rhinotracheale* and salmonellosis. Other viral disease diagnosed was bluecomb enteritis, a Turkey Coronavirus Infection (TCoV).

Chapter 2 Antimicrobial Use

DATA CORRECTIONS IN THE 2019 REPORT: Please note that quantitative estimates presented in the tables and figures slightly varied from previous reports due to further validations of our data with the veterinarians on dose/inclusion rates of antimicrobial active ingredients and corrections to some flock inventories (birds at risk) and pre-harvest sampling age (days at risk). In 2018, one flock sampled in Alberta was misclassified as a British Columbia flock. The changes in quantity of use have not impacted the national and regional temporal variations.

Key findings

- There were 12 antimicrobial active ingredients (AAIs) used in 2019, down from 14 AAIs in 2018.
- The quantity of antimicrobials increased substantially between 2018 and 2019 by 57% in terms of mg/PCU (Figure 2. 1, Table 2. 2, and Textbox 2. 1). Regionally, mg/PCU increased in British Columbia and Ontario by 87% and 84%, respectively while it decreased by 42% and 3% in Alberta and Québec, respectively (Table 2. 3).
- The nDDDvetCA/1,000 turkey-days at risk decreased between 2018 and 2019 by 11% (Figure 2. 3 and Textbox 2. 1). Regionally, this indicator increased by 25% in Ontario, while it decreased in British Columbia, Alberta and Québec by 16%, 70% and 18%, respectively (Table 2. 3).
- The greatest consumption remained for antimicrobials administered via feed (89%) which decreased from 2018 (97%) while the proportion of antimicrobials administered via water increased (11%) from 2018 (3%). A small proportion was administered via injection (0.01%, 1 flock).
- Two flocks reportedly used enrofloxacin, a Veterinary Drugs Directorate's (VDD) Category I antimicrobial.
- Overall, the frequency and quantity of VDD Category II antimicrobials decreased in 2019 by 20%. The VDD Category II comprised of classes administered via feed: streptogramins (1 mg/PCU) and trimethoprim-sulfonamides (7 mg/PCU) and those administered via water such as penicillins (7 mg/PCU) and aminoglycosides (1 mg/PCU). Except for streptogramins, all VDD Category II antimicrobials used in feed and water were for disease treatment.
- VDD's Category III antimicrobial, bacitracin, significantly increased in terms of frequency (27% to 59%) and quantity (30 to 63 mg/PCU) between 2018 and 2019. This class was used for disease prevention (necrotic enteritis).
- Avilamycin, an orthosomycin was another antimicrobial (uncategorized medically-important antimicrobial[4]) used for disease prevention (necrotic enteritis) with minimal

[4] Government of Canada. Health Canada, Veterinary Drugs Directorate. List A: List of certain antimicrobial active pharmaceutical ingredients. Available at: https://www.canada.ca/en/public-health/services/antibiotic-antimicrobial-resistance/animals/veterinary-antimicrobial-sales-reporting/list-a.html.

increase in frequency (3% to 7%) and quantity (0.6 to 1 mg/PCU) between 2018 and 2019.

- Frequency and quantity of use via injections significantly decreased (1 flock reporting gentamicin use).
- All VDD Categories II to III classes comprised of 40% of all antimicrobial quantity in milligrams in 2019, higher by 10% compared to 2018 (Coccidiostat and antiprotozoal use in feed by frequency
- Figure 2. 16). The remaining 64% comprised of non-medically important antimicrobials belonging to ionophores (55%) and chemical coccidiostats (9%). Temporal trends in coccidiostats used are summarized in Figure 2. 17, Figure 2. 18, and Figure 2. 19.

Indicators explained

Textbox 2. 1 Weight-based and dose-based indicators explained

The AACTING consortium (https://aacting.org/) defines an indicator as "a metric (e.g., mg active ingredient or total number of defined daily doses) usually expressed in relation to a denominator representing the population (at risk)". This denominator is what we could call ➡ **the "scaling factor".**

Weight-based indicator: the milligrams per population correction unit (mg/PCU) indicator adjusts the milligrams of an active ingredient by the size of flock population multiplied by the average weight at treatment (turkey = 6.5 kg).

Dose-based indicator: **1)** the milligrams of an active ingredient are adjusted by the defined daily dose (DDD) for animals using Canadian standard (DDDvetCA), this is the average daily dose expressed in milligrams per kilogram turkey per day (mg/kg/day). **2)** the number of DDDvetCA (nDDDvetCA) is adjusted by the population size, standard or average weight (6.5 kg), and days at risk (this is the length of the cycle, meaning that each day during the growing period, the birds are at risk of being treated). The final step multiplies the value by 1,000*.

Example (with actual values):

In 2018, flock **A** in barn **A** was treated with **virginiamycin** (active ingredient) in feed:

$$\Rightarrow \frac{7{,}128{,}061 \text{ mg virginiamycin}}{10{,}000 \text{ turkeys x } 6.5 \text{ kg}} = 178 \ {}^{\text{mg}}/_{\text{PCU}}$$

This antimicrobial has a DDDvetCA of **2.9 mg/kg/day**, growing period is 112 days.

$$\Rightarrow \frac{7{,}128{,}061 \text{ mg virginiamycin} \ / \ 2.9_{\text{mg/kg/day}}}{10{,}000 \text{ turkeys} \times 6.5 \text{ kg} \times 112 \text{ days}} \times 1{,}000 = \mathbf{337} \ {}^{\mathbf{nDDDvetCA}}/_{\mathbf{1{,}000 \text{ turkey days at risk}}}$$

In 2019, flock **B** in barn **A** was treated with **bacitracin** (active ingredient) in feed:

$$\Rightarrow \frac{7{,}496{,}096 \text{ mg bacitracin}}{10{,}000 \text{ turkeys x } 6.5 \text{ kg}} = 187 \ {}^{\text{mg}}/_{\text{PCU}}$$

This antimicrobial has a DDDvetCA of **10 mg/kg/day**, growing period is 112 days.

$$\Rightarrow \frac{7{,}496{,}096 \text{ mg bacitracin} \ / \ 10_{\text{mg/kg/day}}}{10{,}000 \text{ turkeys} \times 6.5 \text{ kg} \times 112 \text{ days}} \times 1{,}000 = \mathbf{102} \ {}^{\mathbf{nDDDvetCA}}/_{\mathbf{1{,}000 \text{ turkey days at risk}}}$$

Why do we see fluctuation between indicators over time?

- **Flock B**: because bacitracin has **higher** inclusion rate in feed (thus **higher** mg/PCU) and has **higher** DDDvetCA, the resulting nDDDvetCA/1,000 turkey-days at risk would be **lower**.
- **Flock A**: for virginiamycin, a streptogramin, which has a **lower** inclusion rate in feed (thus **lower** mg/PCU) and has a **lower** DDDvetCA, the resulting nDDDvetCA/1,000 turkey-days at risk is **higher**.
- **Between flock A and flock B:** variations are observed when antimicrobials are also administered in **water** and other antimicrobials are used in addition to the routine necrotic enteritis program.
- **Not only the quantity of antimicrobials can impact the annual data:** also the antimicrobials that constitute the overall use for that year (vary in inclusion rates, dose, and route of administration). Please consult the **CIPARS 2017 Design and Methods** for more details as well as this publication: https://www.frontiersin.org/articles/10.3389/fvets.2019.00220/full.

*There are many variations of this formula, for example, the TI_{100} (Treatment Incidence, interpreted as the percentage of time an animal of a standard or average weight is treated during the growing period with an antimicrobial).

Medically important antimicrobials[5] and others[6]

Summary of antimicrobials used by routes of administration

Table 2. 1 Number of turkey flocks with reported antimicrobial use by route of administration, 2019

Antimicrobial use	Route of administration			
	Any route[a] n (%)	*In ovo* /subcutaneous n (%)	Feed n (%)	Water n (%)
Any antimicrobial use	65 (66)	1(1)	64 (65)	12 (12)
No antimicrobial use[b]	33 (34)	97 (99)	34 (35)	86 (88)
Total flocks	**98 (100)**	**98 (100)**	**98 (100)**	**98 (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. 2 (next page).

[5] Government of Canada. Health Canada, Veterinary Drugs Directorate. List A: List of certain antimicrobial active pharmaceutical ingredients. Available at: https://www.canada.ca/en/public-health/services/antibiotic-antimicrobial-resistance/animals/veterinary-antimicrobial-sales-reporting/list-a.html.
[6] Others are flavophospholipids or antimicrobial classes belonging to Veterinary Drugs Directorate Category IV other than ionophores.

Table 2. 2 Frequency and quantity of antimicrobial use in turkeys, 2019

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	
						mg/PCU	nDDDvetCA/ 1,000 turkey-days at risk
Feed					g/tonne		
II	Virginiamycin	5 (5)	17 (4)	48 (14 ; 70)	22 (22 ; 22)	1	3
	Trimethoprim-sulfadiazine	6 (6)	6 (1)	13 (7 ; 14)	300 (300 ; 300)	7	13
III	Bacitracin	58 (59)	260 (55)	67 (14 ; 105)	55 (55 ; 110)	63	70
	Chlortetracycline	2 (2)	2 (< 1)	13 (10 ; 15)	330 (220 ; 440)	2	1
IV	Bambermycin	5 (5)	17 (4)	60 (60 ; 102)	2 (2 ; 2)	0.2	
N/A	Avilamycin	7 (7)	17 (4)	43 (35 ; 56)	20 (15 ; 25)	1	4
No AMU in feed		35 (35)	156 (33)				
Total feed, medicated		**64 (65)**	**319 (67)**			**75**	**92**
Water		**Treatment (n)**			**mg/bird median (min ; max)[c]**		
I	Enrofloxacin	2 (2)	2	4 (4 ; 4)	11 (10 ; 13)	0.1	0.1
II	Amoxicillin	2 (2)	2	6 (5 ; 6)	264 (115 ; 413)	< 0.1	0.4
	Penicillin G potassium	6 (6)	6	6 (4 ; 10)	415 (42 ; 1786)	1	1
	Neomycin	1 (1)	1	5 (5 ; 5)	401 (401 ; 401)	7	2
III	Tetracycline	3 (3)	4	7 (5 ; 10)	45 (31 ; 227)	1	0.4
No AMU in water		86 (88)					
Total water, medicated		**12 (12)**	**15**			**9**	**3**
Injection					**mg/egg or poult**		
II	Gentamicin	1 (1)			1	< 0.1	< 0.1
No AMU via injection		97 (97)					
Total injection		**1 (1)**				**< 0.1**	**< 0.1**
All routes[d]		**65 (66)**				**84**	**95**

See corresponding footnotes on next page.

Table 2. 2 Frequency and quantity of antimicrobial use summary, 2019 (continued)

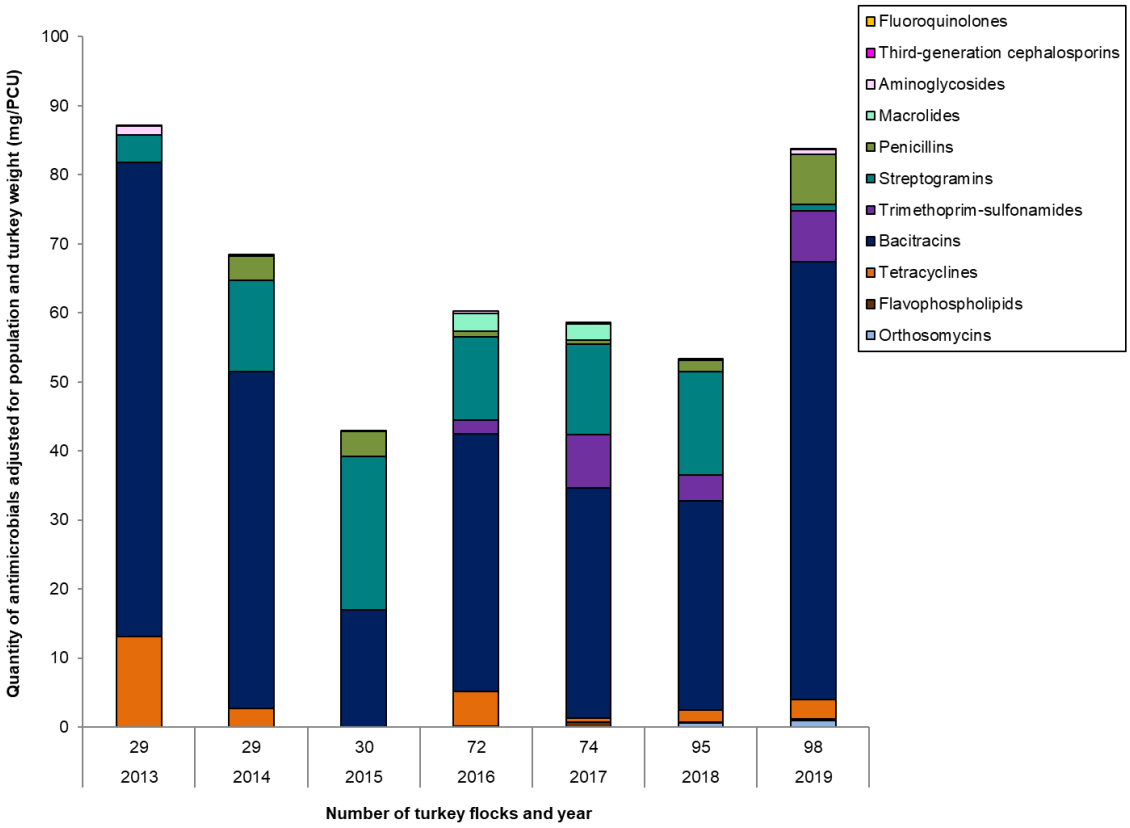
Roman numerals I to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).
AMU = antimicrobial use.
Combination antimicrobials include the values for both antimicrobial 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 2019 CIPARS Design and Methods, Table A. 1 for the list of standards.
nDDDvetCA/1,000 turkey-days at risk = number of DDDvetCA/1,000 turkey-days at risk.
[a] Days exposed are full grow-out or 1 course of water treatment.
[b] Level of drug is in grams/tonne of feed. In poults or hatching eggs, level of drug is in milligrams per poult or hatching egg, as reported by the veterinarian/producer.
[c] For water medications, the total milligrams per bird administered throughout the course of treatment is reported above; estimation methods changed where total products used by the flock was reported instead of grams per liter of drinking water (2013 to 2018 methods).
[d] The final mg/PCU and nDDDvetCA/1,000 turkey-days at risk exclude coccidiostats. Flavophospholipids was included only in the mg/PCU.

Table 2. 3 Production, biomass, and quantity of antimicrobials used by province, 2015 to 2019

Province	Year	Number of flocks	Pre-harvest weight Mean (kg)	Age sampled Mean (days)	Active ingredient (mg)	Turkey weights[a] (kg)	mg/PCU		nDDDvetCA/1,000 turkey-days at risk	
							Total	%change[b]	Total	%change[b]
British Columbia	2015	30	9	88	74,648,523	1,736,982	43		109	
	2016	30	9	88	96,083,820	1,973,663	49	13	86	-21
	2017	27	9	89	109,183,975	1,599,299	68	40	122	42
	2018	30	9	88	78,374,747	1,555,057	50	-26	123	1
	2019	31	9	88	158,397,497	1,684,303	94	87	104	-16
Alberta	2018	10	9	86	31,565,138	526,087	60		117	
	2019	10	9	88	17,065,044	488,599	35	-42	35	-70
Ontario	2016	30	10	91	101,392,940	1,170,514	87		129	
	2017	31	10	89	79,958,950	1,353,274	59	-32	102	-21
	2018	30	9	84	67,659,477	1,003,483	67	14	108	6
	2019	30	10	90	162,071,642	1,309,285	124	84	135	25
Québec	2016	12	12	96	21,101,616	485,394	43		67	
	2017	16	11	90	20,384,973	626,239	33	-25	60	-10
	2018	25	11	90	33,445,259	873,834	38	18	70	17
	2019	27	11	89	36,646,907	985,654	37	-3	58	-18
National[c]	2016	72	10	90	218,578,376	3,629,571	60		97	
	2017	74	10	89	209,527,898	3,578,812	59	-3	103	7
	2018	95	10	87	211,044,621	3,958,461	53	-9	107	3
	2019	98	10	89	374,181,091	4,467,840	84	57	95	-11

Some values presented in this report slightly differ from the previous year's reports due to flock size corrections, improvement to the database and methodology refinements.
mg/PCU = milligrams/population correction unit.
DDDvetCA = Canadian Defined Daily Doses for animals (average labelled dose) in milligrams per kilogram turkey per day (mg_{drug}/kg_{animal}/day); please refer to 2019 CIPARS Design and Methods, Table A. 1 for the list of standards.
nDDDvetCA/1,000 turkey-days at risk = number of DDDvetCA/1,000 turkey-days at risk.
[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 surveyed and combines the quantity of antimicrobials used in feed, water and injection excluding coccidiostats, antiprotozoals and flavophospholipids.

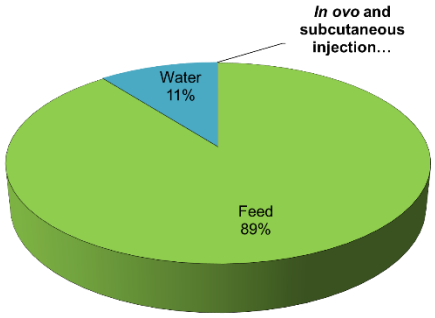
Figure 2. 1 Quantity of antimicrobial use in all routes of administration, adjusted for population and turkey weight (mg/PCU), 2013 to 2019

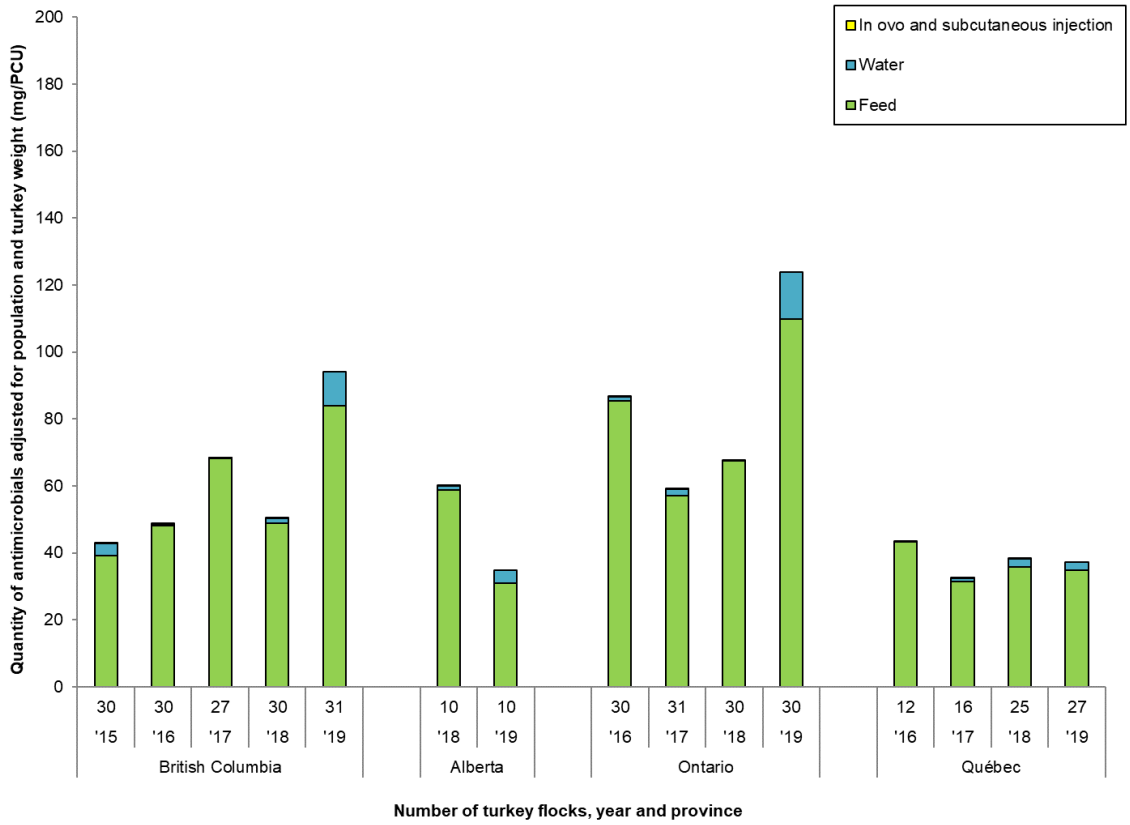


Year Number of flocks		2013 29	2014 29	2015 30	2016 72	2017 74	2018 95	2019 98
Antimicrobial class								
I	Fluoroquinolones	0	0	0	0	< 0.1	< 0.1	0.1
	Third-generation cephalosporins	< 0.1	0	0	0	0	0	0
II	Aminoglycosides	1	0.3	0.1	0.3	0.2	0.2	1
	Macrolides	0	0	0	3	2	0	0
	Penicillins	0.0	3	4	1	1	2	7
	Streptogramins	4	13	22	12	13	15	1
	Trimethoprim-sulfonamides	0	0	0	2	8	4	7
III	Bacitracins	69	49	17	37	33	30	63
	Tetracyclines	13	3	0	5	1	2	3
IV	Flavophospholipids	0	0	0	0.1	0.7	0.1	0.2
N/A	Orthosomycins	0	0	0	0	0	1	1
Total		**87**	**68**	**43**	**60**	**59**	**53**	**84**

Roman numerals I to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification available at the time of writing of this report).
mg/PCU = milligrams/population correction unit.
For detailed indicator descriptions, please refer to the CIPARS 2019: Design and Methods document.
2013 to 2015 data pertains to British Columbia.
Please note, estimates have slightly varied from previous reports due to correction on the dose or level of drugs, days at risk, and birds at risk. One Alberta flock was misclassified as a British Columbia flock in 2018.

Figure 2. 2 Quantity of antimicrobials, adjusted for population and turkey weight (mg/PCU), in 2019 and by province, 2015 to 2019

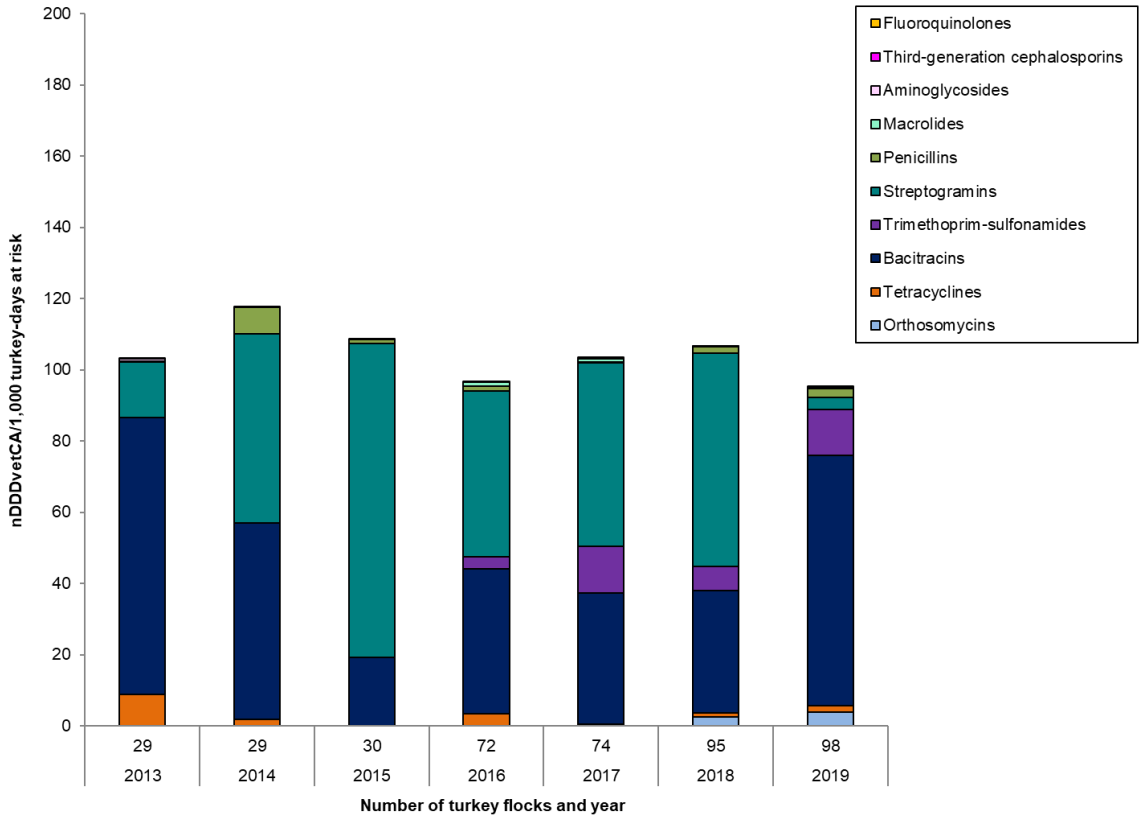




Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Route of administration															
Feed	**39**	**48**	**68**	**49**	**84**	**59**	**31**	**85**	**57**	**67**	**110**	**43**	**32**	**36**	**35**
Water	**4**	**0.4**	**0**	**2**	**10**	**1**	**4**	**1**	**2**	**0**	**14**	**0**	**1**	**3**	**2**
In ovo and subcutaneous injection	**0.1**	**0.1**	**0.1**	**< 0.1**	**0**	**< 0.1**	**0**	**0.1**	**0.1**	**< 0.1**	**0**	**0.1**	**0.1**	**< 0.1**	**0**
Total	**43**	**49**	**68**	**50**	**94**	**60**	**35**	**87**	**59**	**67**	**124**	**43**	**33**	**38**	**37**

mg/PCU = milligrams/population correction unit .
Data in figure pertains to the current year (pie) and data in table includes 2 to 5 years.

Figure 2. 3 Number of Canadian Defined Daily Doses for animals per 1,000 turkey-days at risk (nDDDvetCA/1,000 turkey-days at risk) for all routes of administration, 2013 to 2019

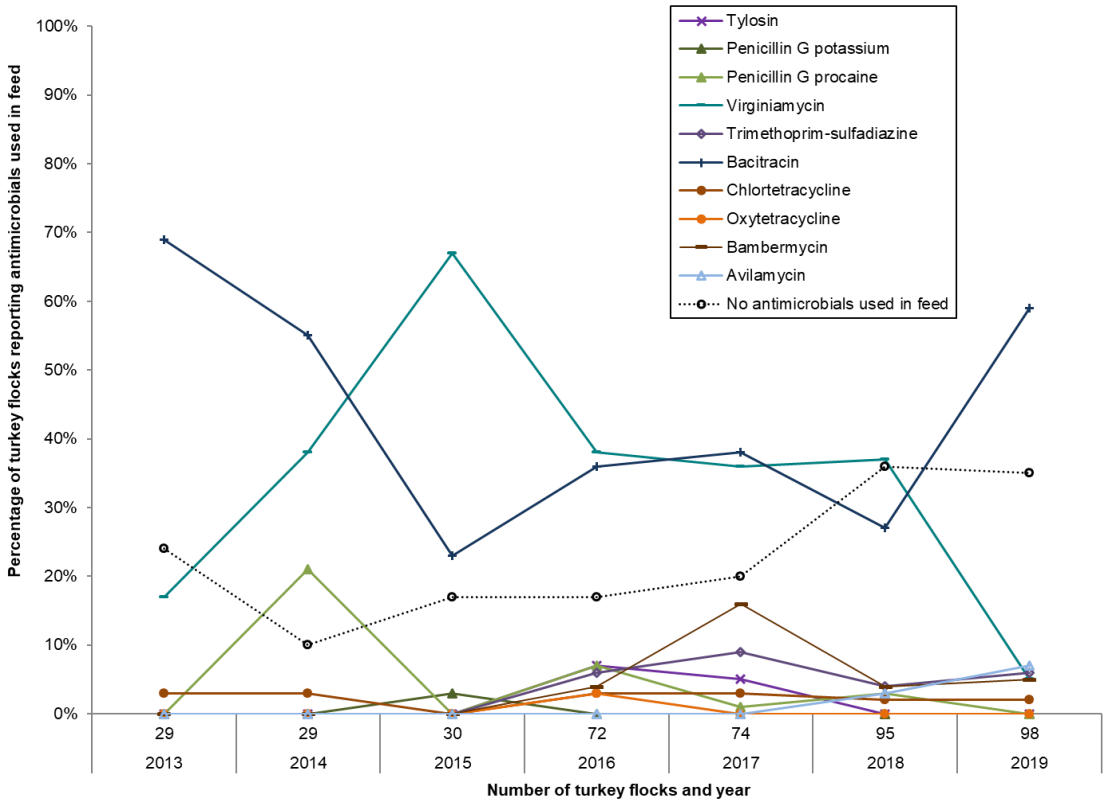


Year Number of flocks		2013 29	2014 29	2015 30	2016 72	2017 74	2018 95	2019 98
Antimicrobial class								
I	Fluoroquinolones	0	0	0	0	< 0.1	< 0.1	0.1
	Third-generation cephalosporins	< 0.1	0	0	0	0	0	0
II	Aminoglycosides	0.7	0	0.1	0	0.2	0.1	0
	Macrolides	0	0	0	1	1	0	0
	Penicillins	0	7	1	1	0	2	2
	Streptogramins	16	53	88	47	52	60	3
	Trimethoprim-sulfonamides	0	0	0	3	13	7	13
III	Bacitracins	78	55	19	41	37	34	70
	Tetracyclines	9	2	0	3	0.4	1.1	2
N/A	Orthosomycins	0	0	0	0	0	2	4
Total		**103**	**118**	**109**	**97**	**103**	**107**	**95**

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 turkey per day ($mg_{drug}/kg_{animal}/day$); please refer to 2019 CIPARS Design and Methods, Table A. 1 for the list of standards.
nDDDvetCA/1,000 turkey-days at risk = number of DDDvetCA/1,000 turkey-days at risk.
For detailed indicator descriptions, please refer to the CIPARS 2019: Design and Methods document.
2013 to 2015 data pertains to British Columbia.

Antimicrobial use in feed by frequency

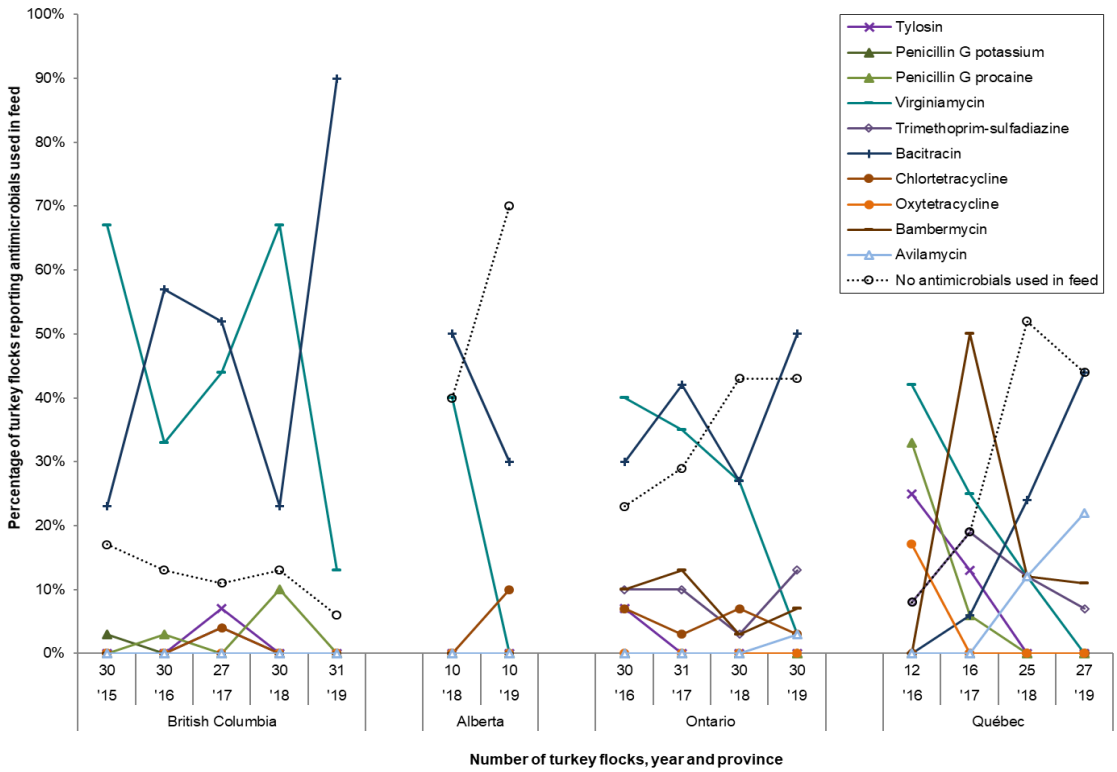
Figure 2. 4 Percentage of turkey flocks reporting antimicrobial use in feed, 2013 to 2019



Year	2013	2014	2015	2016	2017	2018	2019
Number of flocks	29	29	30	72	74	95	98
Antimicrobial							
Tylosin	0%	0%	0%	**7%**	5%	**0%**	**0%**
Penicillin G potassium	0%	0%	3%	**0%**	0%	**0%**	**0%**
II Penicillin G procaine	0%	21%	0%	**7%**	1%	**3%**	**0%**
Virginiamycin	17%	38%	67%	**38%**	36%	**37%**	**5%**
Trimethoprim-sulfadiazine	0%	0%	0%	**6%**	9%	**4%**	**6%**
Bacitracin	69%	55%	23%	**36%**	38%	**27%**	**59%**
III Chlortetracycline	3%	3%	0%	**3%**	3%	**2%**	**2%**
Oxytetracycline	0%	0%	0%	**3%**	0%	**0%**	**0%**
IV Bambermycin	0%	0%	0%	**4%**	16%	**4%**	**5%**
N/A Avilamycin	0%	0%	0%	**0%**	0%	**3%**	**7%**
No antimicrobials used in feed	24%	10%	17%	**17%**	20%	**36%**	**35%**

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).
Numbers per column may not add up to 100% as some flocks may have used an antimicrobial more than once or used multiple antimicrobials throughout the grow-out period.
For the temporal analyses, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in 2016 (program started at the national level) and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.
Please note that the "no antimicrobials used in feed" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories II to IV and avilamycin).
2013 to 2015 data pertains to British Columbia.

Figure 2. 5 Percentage of turkey flocks reporting antimicrobials used in feed, by province, 2015 to 2019

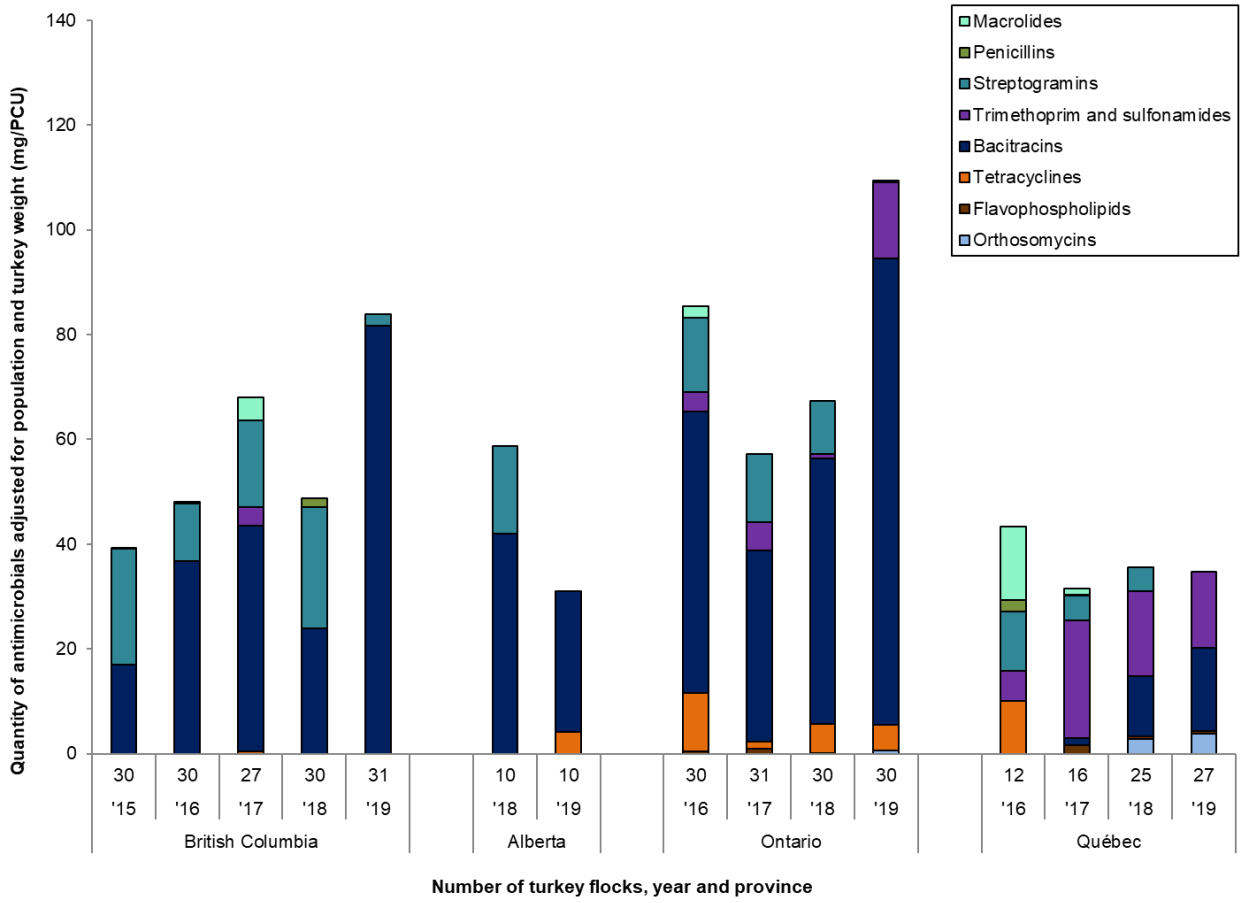


Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Antimicrobial															
Tylosin	0%	**0%**	7%	**0%**	**0%**	**0%**	**0%**	**7%**	0%	**0%**	**0%**	**25%**	13%	**0%**	**0%**
Penicillin G potassium	3%	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**
II Penicillin G procaine	0%	**3%**	0%	**10%**	**0%**	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**33%**	6%	**0%**	**0%**
Virginiamycin	67%	**33%**	44%	**67%**	**13%**	**40%**	**0%**	**40%**	35%	**27%**	**3%**	**42%**	25%	**12%**	**0%**
Trimethoprim-sulfadiazine	0%	**0%**	4%	**0%**	**0%**	**0%**	**0%**	**10%**	10%	**3%**	**13%**	**8%**	19%	**12%**	**7%**
Bacitracin	23%	**57%**	52%	**23%**	**90%**	**50%**	**30%**	**30%**	42%	**27%**	**50%**	**0%**	6%	**24%**	**44%**
III Chlortetracycline	0%	**0%**	4%	**0%**	**0%**	**0%**	**10%**	**7%**	3%	**7%**	**3%**	**0%**	0%	**0%**	**0%**
Oxytetracycline	0%	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**17%**	0%	**0%**	**0%**
IV Bambermycin	0%	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**10%**	13%	**3%**	**7%**	**0%**	50%	**12%**	**11%**
N/A Avilamycin	0%	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	0%	**0%**	**3%**	**0%**	0%	**12%**	**22%**
No antimicrobials used in feed	17%	**13%**	11%	**13%**	**6%**	**40%**	**70%**	**23%**	29%	**43%**	**43%**	**8%**	19%	**52%**	**44%**

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).
Numbers per column may not add up to 100% as some flocks may have used an antimicrobial more than once or used multiple antimicrobials throughout the grow-out period.
For the temporal analyses within province, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in 2016 (program started at the national level) and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province ($P \leq 0.05$) for a given antimicrobial. The presence of red areas indicates significant provincial differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province).
Please note that the "no antimicrobials used in feed" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories II to IV and avilamycin).

Antimicrobial use in feed by quantitative indicators

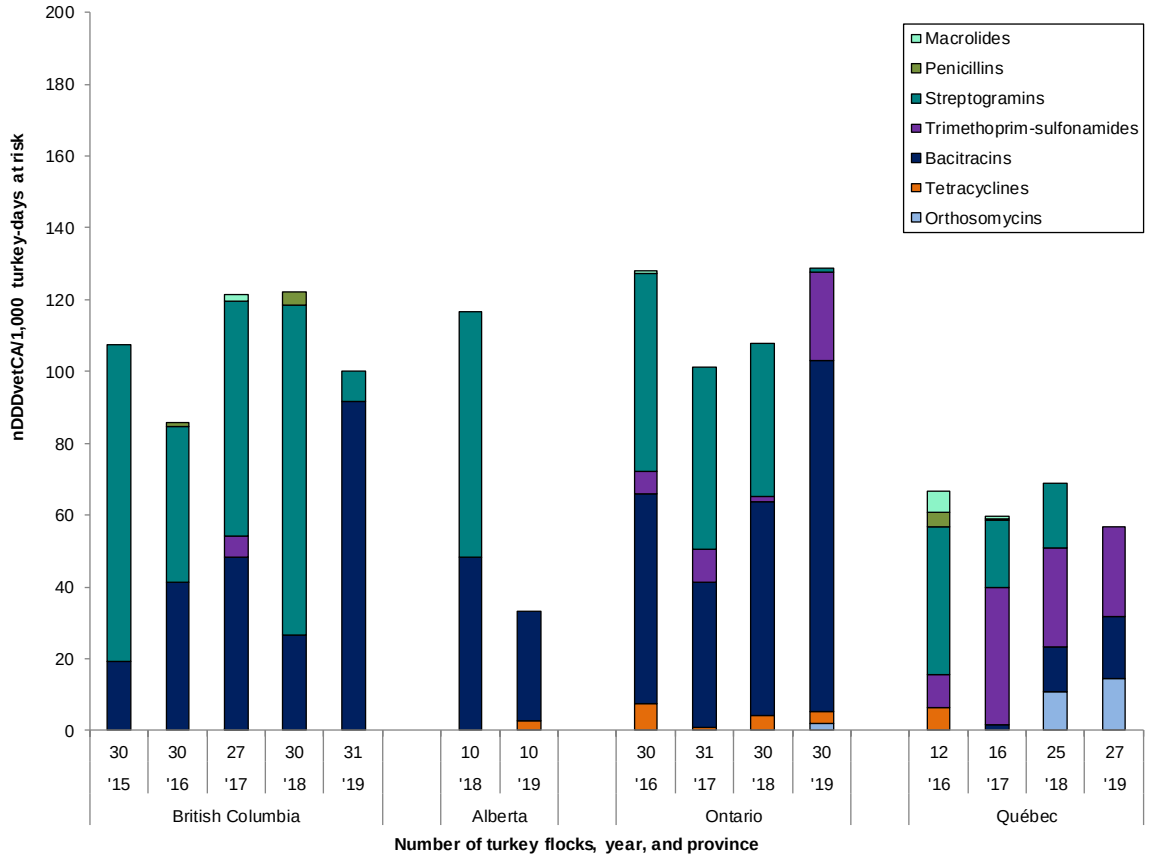
Figure 2. 6 Quantity of antimicrobial use in feed adjusted for population and turkey weight (mg/PCU), by province, 2015 to 2019



Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Antimicrobial class															
II Macrolides	0	0	5	0	0	0	0	2	0	0	0	14	1	0	0
II Penicillins	< 0.1	0.4	0	2	0	0	0	0	0	0	0	2	0	0	0
II Streptogramins	22	11	17	23	2	17	0	14	13	10	0	11	5	5	0
II Trimethoprim and sulfonamides	0	0	4	0	0	0	0	4	5	1	15	6	22	16	15
III Bacitracins	17	37	43	24	82	42	27	54	37	51	89	0	1	12	16
III Tetracyclines	0	0	0	0	0	0	4	11	1	6	5	10	0	0	0
IV Flavophospholipids	0	0	0	0	0	0	0	0	1	0	0.1	0	2	0	0.6
N/A Orthosomycins	0	0	0	0	0	0	0	0	0	0	1	0	0	3	4
Total	39	48	68	49	84	59	31	85	57	67	109	43	32	36	35

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).
mg/PCU = milligrams/population correction unit.
For detailed indicator descriptions, please refer to the CIPARS 2019: Design and Methods document.

Figure 2. 7 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, by province, 2015 to 2019

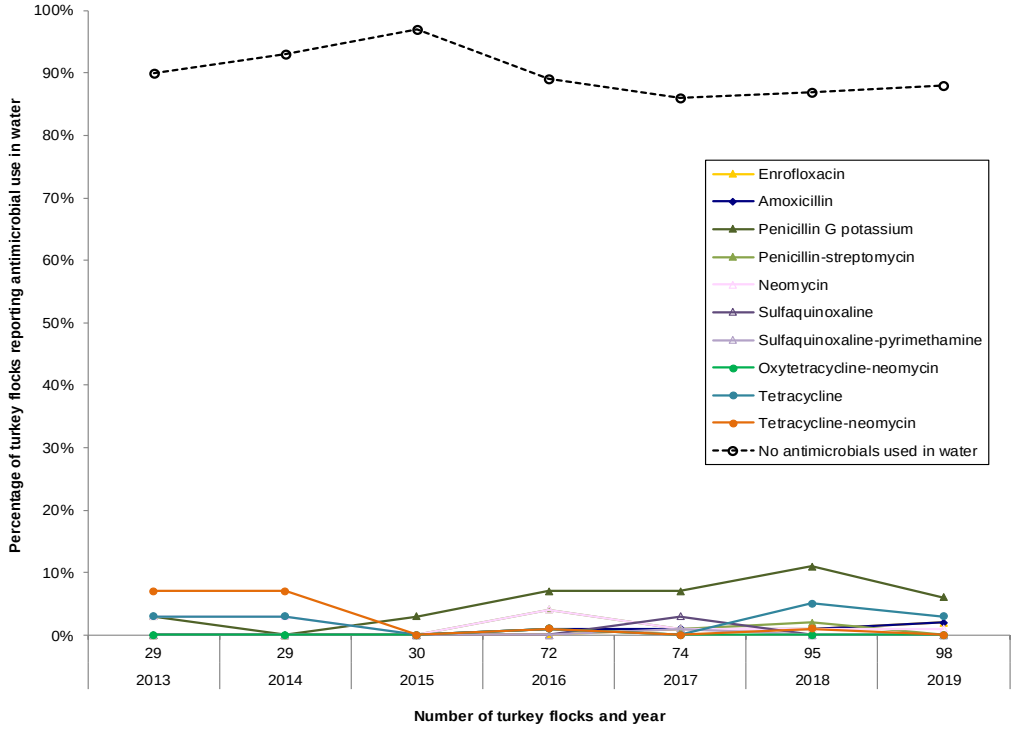


Province		British Columbia					Alberta		Ontario				Québec			
Year		'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks		30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Antimicrobial class																
II	Macrolides	0	0	2	0	0	0	0	1	0	0	0	6	1	0	0
	Penicillins	0	1	0	4	0	0	0	0	0	0	0	4	0	0	0
	Streptogramins	88	43	65	92	8	68	0	55	51	43	1	41	19	18	0
	Trimethoprim-sulfonamides	0	0	6	0	0	0	0	6	9	2	25	9	38	28	25
III	Bacitracins	19	41	48	27	92	48	30	59	40	60	98	0	2	13	17
	Tetracyclines	0	0	0	0	0	0	3	7	1	4	3	6	0	0	0
N/A Orthosomycins		0	0	0	0	0	0	0	0	0	0	2	0	0	11	14
Total		**107**	**86**	**122**	**122**	**100**	**117**	**33**	**128**	**101**	**108**	**129**	**67**	**60**	**69**	**57**

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 turkey per day (mg_{drug}/kg_{animal}/day); please refer to 2019 CIPARS Design and Methods, Table A. 1 for the list of standards..
nDDDvetCA/1,000 turkey-days at risk = number of DDDvetCA/1,000 turkey-days at risk.
For detailed indicator descriptions, please refer to the CIPARS 2019: Design and Methods document.

Antimicrobial use in water by frequency

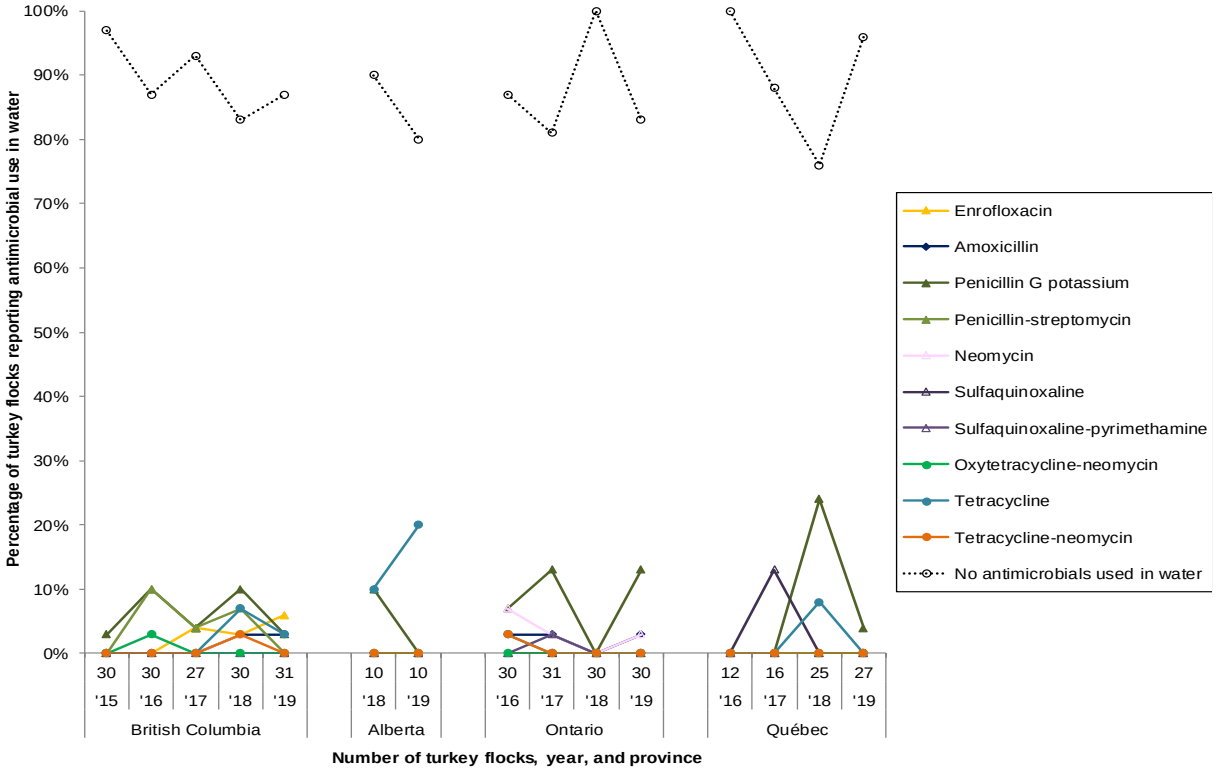
Figure 2. 8 Percentage of turkey flocks reporting antimicrobial use in water, 2013 to 2019



Year	2013	2014	2015	2016	2017	2018	2019
Number of flocks	29	29	30	72	74	95	98
Antimicrobial							
I Enrofloxacin	0%	0%	0%	**0%**	1%	**1%**	**2%**
II Amoxicillin	0%	0%	0%	**1%**	1%	**1%**	**2%**
II Penicillin G potassium	3%	0%	3%	**7%**	7%	**11%**	**6%**
II Penicillin-streptomycin	0%	0%	0%	**4%**	1%	**2%**	**0%**
II Neomycin	3%	3%	0%	**4%**	1%	**1%**	**1%**
III Sulfaquinoxaline	0%	0%	0%	**0%**	3%	**0%**	**0%**
III Sulfaquinoxaline-pyrimethamine	0%	0%	0%	**0%**	1%	**0%**	**0%**
III Oxytetracycline-neomycin	0%	0%	0%	**1%**	0%	**0%**	**0%**
III Tetracycline	3%	3%	0%	**1%**	0%	**5%**	**3%**
III Tetracycline-neomycin	7%	7%	0%	**1%**	0%	**1%**	**0%**
No antimicrobials used in water	90%	93%	97%	**89%**	86%	**87%**	**88%**

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 2016 (program started at the national level) and previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.
2013 to 2015 data pertains to British Columbia.
Please note that the "no antimicrobials used in water" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories I to III).

Figure 2. 9 Percentage of turkey flocks reporting antimicrobial use in water, by province, 2015 to 2019

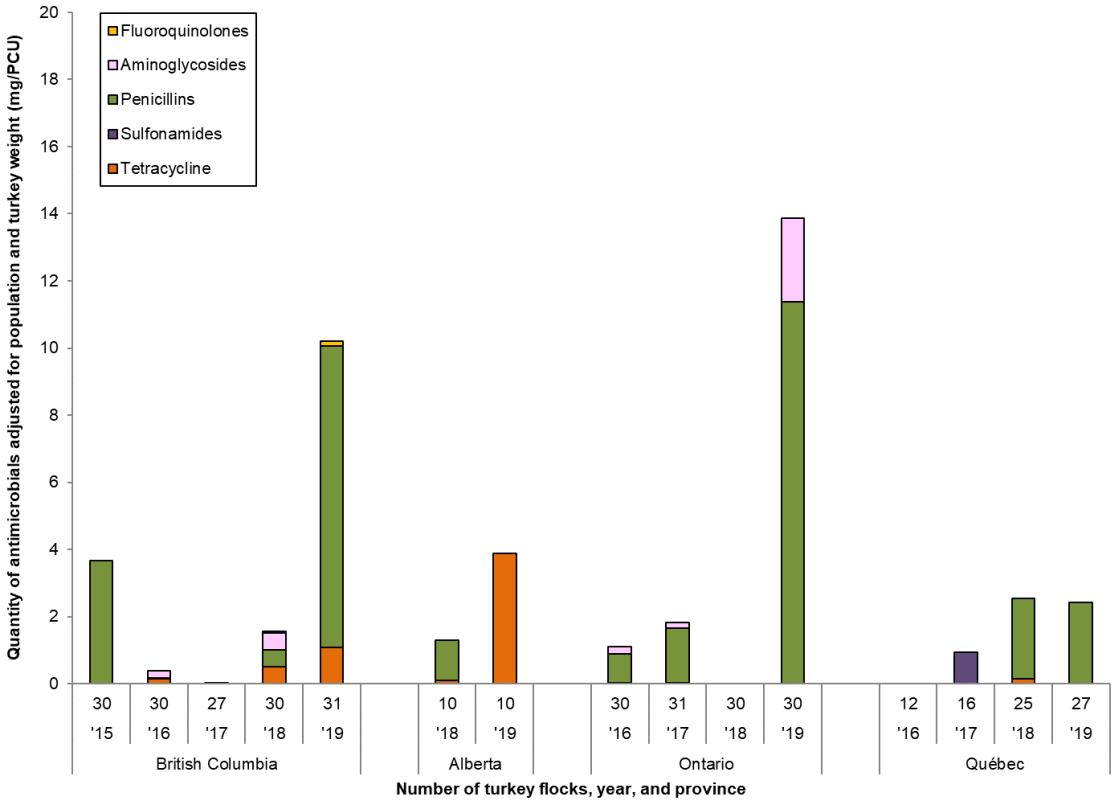


Province		British Columbia					Alberta		Ontario				Québec			
Year		'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks		30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Antimicrobial																
I	Enrofloxacin	0%	**0%**	4%	**3%**	**6%**	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**
II	Amoxicillin	0%	**0%**	0%	**3%**	**3%**	**0%**	**0%**	**3%**	3%	**0%**	**3%**	**0%**	0%	**0%**	**0%**
II	Penicillin G potassium	3%	**10%**	4%	**10%**	**3%**	**10%**	**0%**	**7%**	13%	**0%**	**13%**	**0%**	0%	**24%**	**4%**
II	Penicillin-streptomycin	0%	**10%**	4%	**7%**	**0%**	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**
II	Neomycin	0%	**3%**	0%	**3%**	**0%**	**0%**	**0%**	**7%**	3%	**0%**	**3%**	**0%**	0%	**0%**	**0%**
III	Sulfaquinoxaline	0%	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	13%	**0%**	**0%**
III	Sulfaquinoxaline-pyrimethamine	0%	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	3%	**0%**	**0%**	**0%**	0%	**0%**	**0%**
III	Oxytetracycline-neomycin	0%	**3%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**
III	Tetracycline	0%	**0%**	0%	**7%**	**3%**	**10%**	**20%**	**3%**	0%	**0%**	**0%**	**0%**	0%	**8%**	**0%**
III	Tetracycline-neomycin	0%	**0%**	0%	**3%**	**0%**	**0%**	**0%**	**3%**	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**
	No antimicrobials used in water	97%	**87%**	93%	**83%**	**87%**	**90%**	**80%**	**87%**	81%	**100%**	**83%**	**100%**	88%	**76%**	**96%**

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 within province, the proportion (%) of flocks using a specific antimicrobial in the current year has been compared to the proportion (%) of flocks using the same antimicrobial in 2016 (program started at the national level) and previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial. The presence of blue areas indicates significant temporal differences within province ($P \leq 0.05$) for a given antimicrobial. The presence of red areas indicates significant provincial differences ($P \leq 0.05$) for a given antimicrobial within the current year (Québec-referent province).
Please note that the "no antimicrobials used in water" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories I to III).

Antimicrobial use in water by quantitative indicators

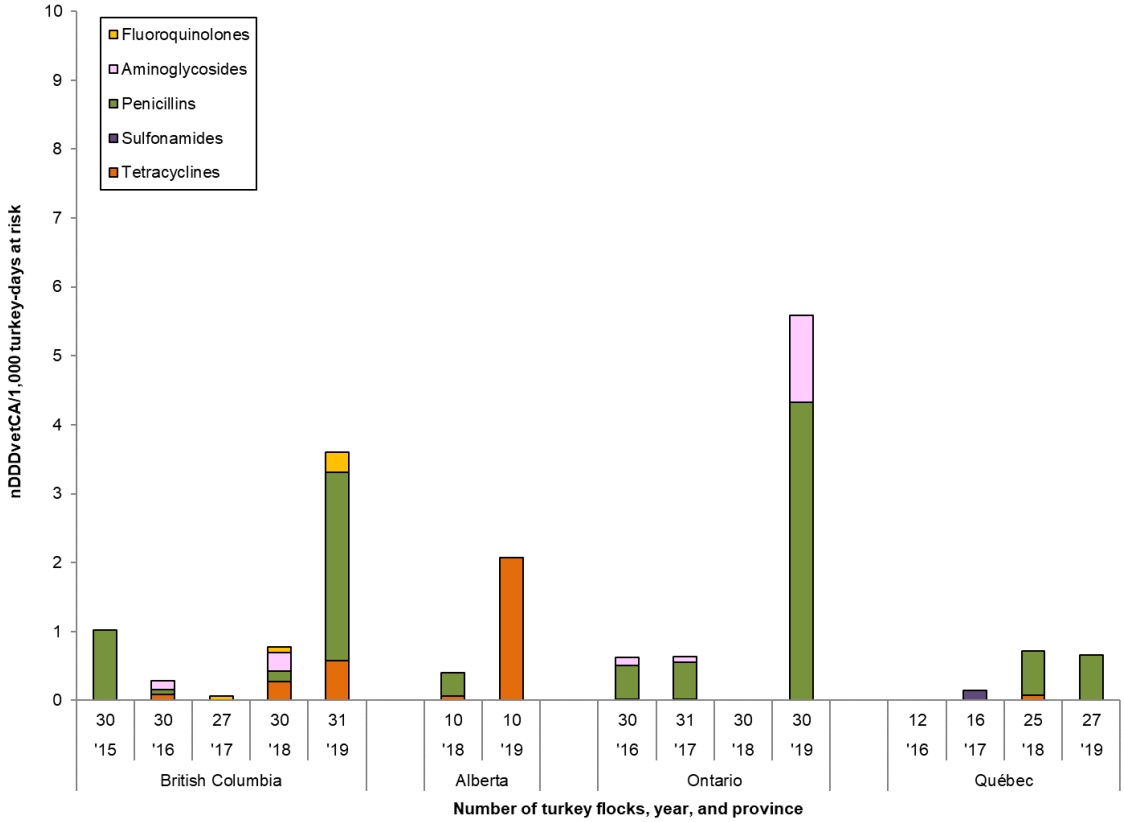
Figure 2. 10 Quantity of antimicrobial use in water adjusted for population and turkey weight (mg/PCU), by province, 2015 to 2019



Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Antimicrobial class															
I Fluoroquinolones	0	0	< 0.1	< 0. 1	0.2	0	0	0	0	0	0	0	0	0	0
II Aminoglycosides	0	0.2	0	1	0	0	0	0.2	0.2	0	2	0	0	0	0
II Penicillins	4	0	0	1	9	1	0	1	2	0	11	0	0	2	2
III Sulfonamides	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
III Tetracyclines	0	0.2	0	1	1	0.1	4	0	0	0	0	0	0	0	0
Total	**4**	**0.4**	**0**	**2**	**10**	**1**	**4**	**1**	**2**	**0**	**14**	**0**	**1**	**3**	**2**

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
mg/PCU = milligrams/population correction unit.
For detailed indicator descriptions, please refer to the CIPARS 2019: Design and Methods document.
Please note, estimates have slightly changed from previous reports as a result of ongoing refinements to the database, flock population, dose corrections, and rounding.

Figure 2. 11 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, by province, 2015 to 2019

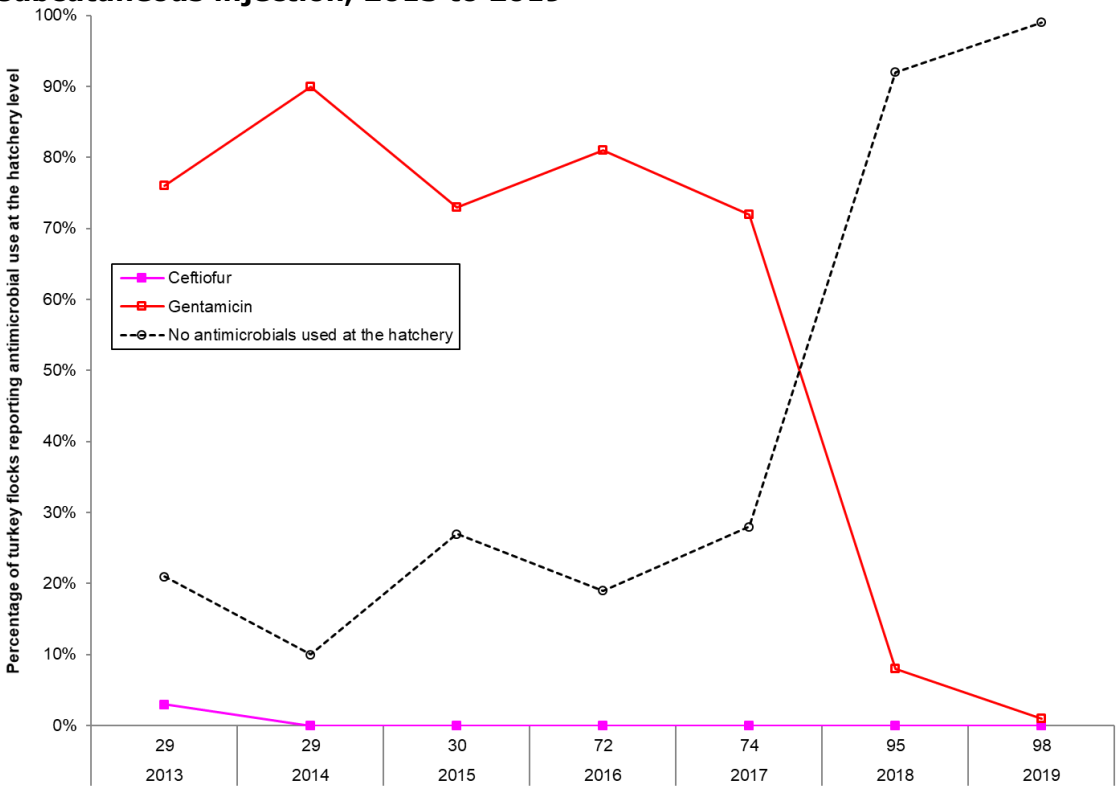


Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Antimicrobial class															
I Fluoroquinolones	0	0	0.1	0.1	0.3	0	0	0	0	0	0	0	0	0	0
II Aminoglycosides	0	0.1	0	0.3	0	0	0	0.1	0.1	0	1	0	0	0	0
II Penicillins	1	0.1	0	0.2	2.7	0.3	0	0.5	0.5	0	4	0	0	1	0.7
III Sulfonamides	0	0	0	0	0	0	0	0	< 0.1	0	0	0	0.1	0	0
III Tetracyclines	0	0.1	0	0.3	1	0.1	2	< 0.1	0	0	0	0	0	0.1	0
Total	**1.0**	**0.3**	**0.1**	**0.8**	**3.6**	**0.4**	**2.1**	**0.6**	**0.6**	**0**	**6**	**0**	**0.1**	**0.7**	**0.7**

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 per day (mg_{drug}/kg_{animal}/day); please refer to 2019 CIPARS Design and Methods, Table A. 1 for the list of standards.
nDDDvetCA/1,000 turkey-days at risk = number of DDDvetCA/1,000 turkey-days at risk.
For detailed indicator descriptions, please refer to the CIPARS 2019: Design and Methods document.
Please note, estimates have slightly changed from previous reports as a result of ongoing refinements to the database, flock population, dose corrections, and rounding.

Antimicrobials use *in ovo* or subcutaneous injection by frequency

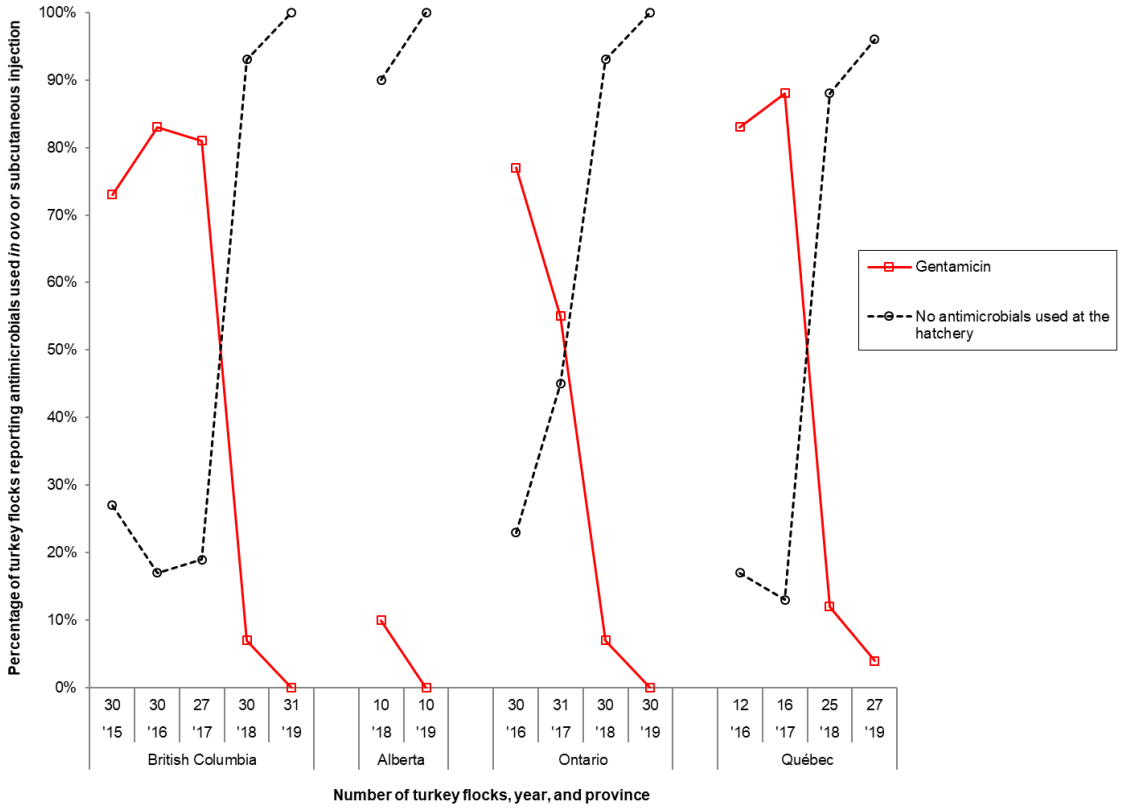
Figure 2. 12 Percentage of turkey flocks reporting antimicrobials use *in ovo* or subcutaneous injection, 2013 to 2019



Year	2013	2014	2015	2016	2017	2018	2019
Number of flocks	29	29	30	72	74	95	98
Antimicrobial							
I Ceftiofur	3%	0%	0%	**0%**	0%	**0%**	**0%**
II Gentamicin	76%	90%	73%	**81%**	72%	**8%**	**1%**
No antimicrobials used at the hatchery	21%	10%	27%	**19%**	28%	**92%**	**99%**

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 2016 (national program started) and previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given antimicrobial.
Please note that the "no antimicrobials used at the hatchery" pertains to flocks that did not use any of the antimicrobial classes included in this figure (Categories I and II).
2013 to 2015 data pertains to British Columbia.

Figure 2. 13 Percentage of turkey flocks reporting antimicrobials use *in ovo* or subcutaneous injection, by province, 2015 to 2019

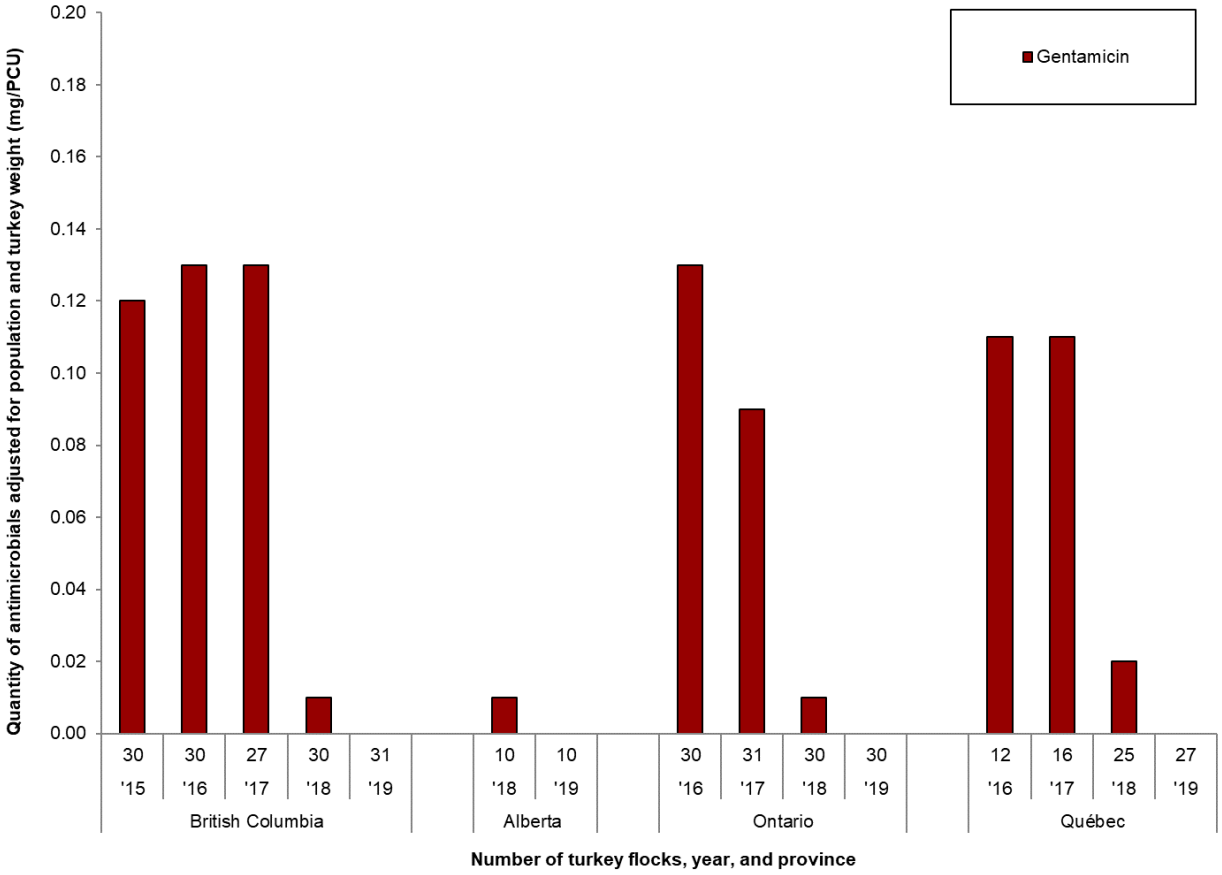


Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Antimicrobial															
II Gentamicin	73%	**83%**	81%	**7%**	**0%**	**10%**	**0%**	**77%**	55%	**7%**	**0%**	**83%**	88%	**12%**	**4%**
No antimicrobials used at the hatchery	27%	**17%**	19%	**93%**	**100%**	**90%**	**100%**	**23%**	45%	**93%**	**100%**	**17%**	13%	**88%**	**96%**

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

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

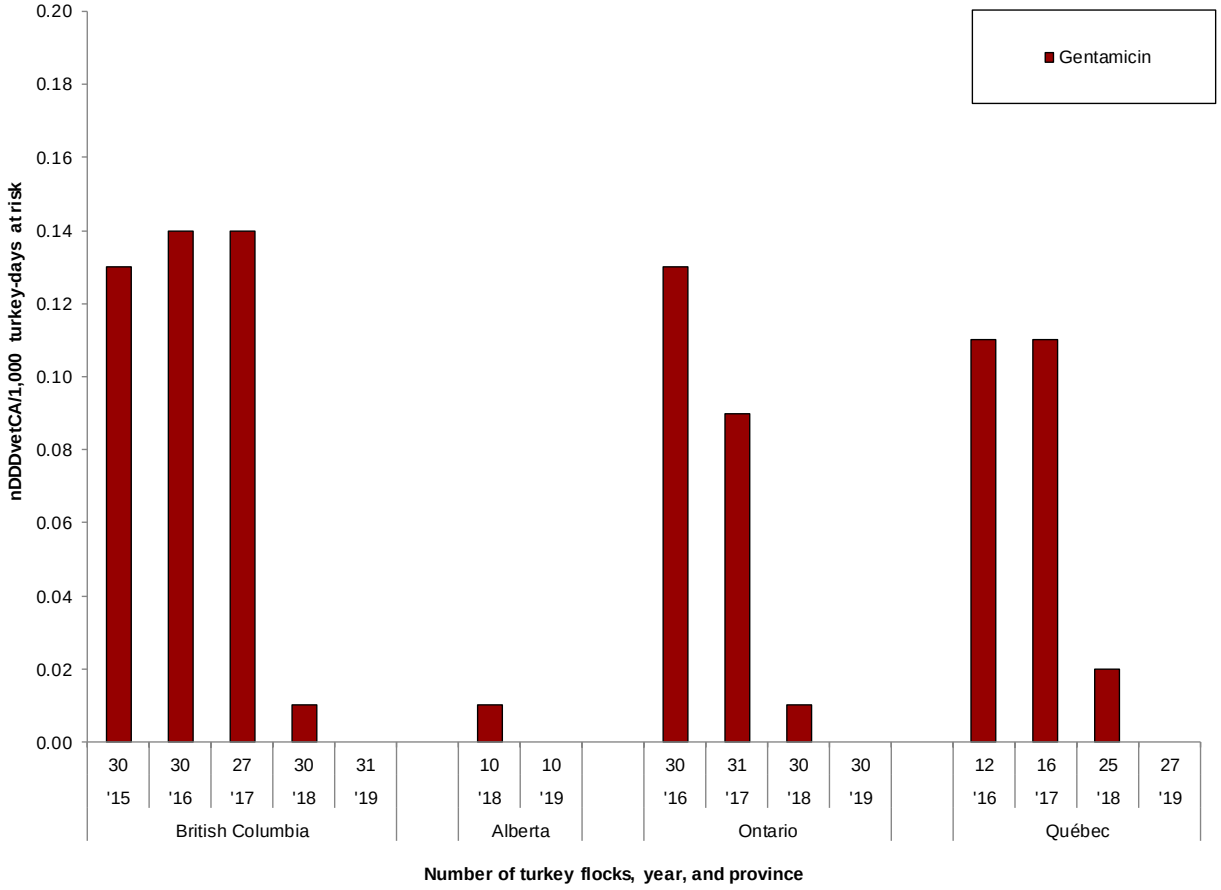
Figure 2. 14 Quantity of antimicrobials used *in ovo* or subcutaneous injections adjusted for population and turkey weight (mg/PCU), by province, 2015 to 2019



Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Antimicrobial															
II Gentamicin	**0.12**	**0.13**	**0.13**	**0.01**	**0**	**0.01**	**0**	**0.13**	**0.09**	**0.01**	**0**	**0.11**	**0.11**	**0.02**	**0**
Total	**0.12**	**0.13**	**0.13**	**0.01**	**0**	**0.01**	**0**	**0.13**	**0.09**	**0.01**	**0**	**0.11**	**0.11**	**0.02**	**0**

Roman numeral II indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Total milligrams active ingredient was calculated using the final dose (in milligrams per hatching egg or poult) suggested by the manufacturer and expert opinion based on milligrams per body weight or residue avoidance information: gentamicin routine dose (1 mg/poult).
mg/PCU = milligrams/population correction unit.
For detailed indicator descriptions, please refer to the CIPARS 2019: Design and Methods document.

Figure 2. 15 Number of Canadian Defined Daily Doses for animals per 1,000 turkey-days (nDDDvetCA/1,000 turkey-days at risk) for antimicrobials administered *in ovo* or subcutaneous injection, by province, 2015 to 2019

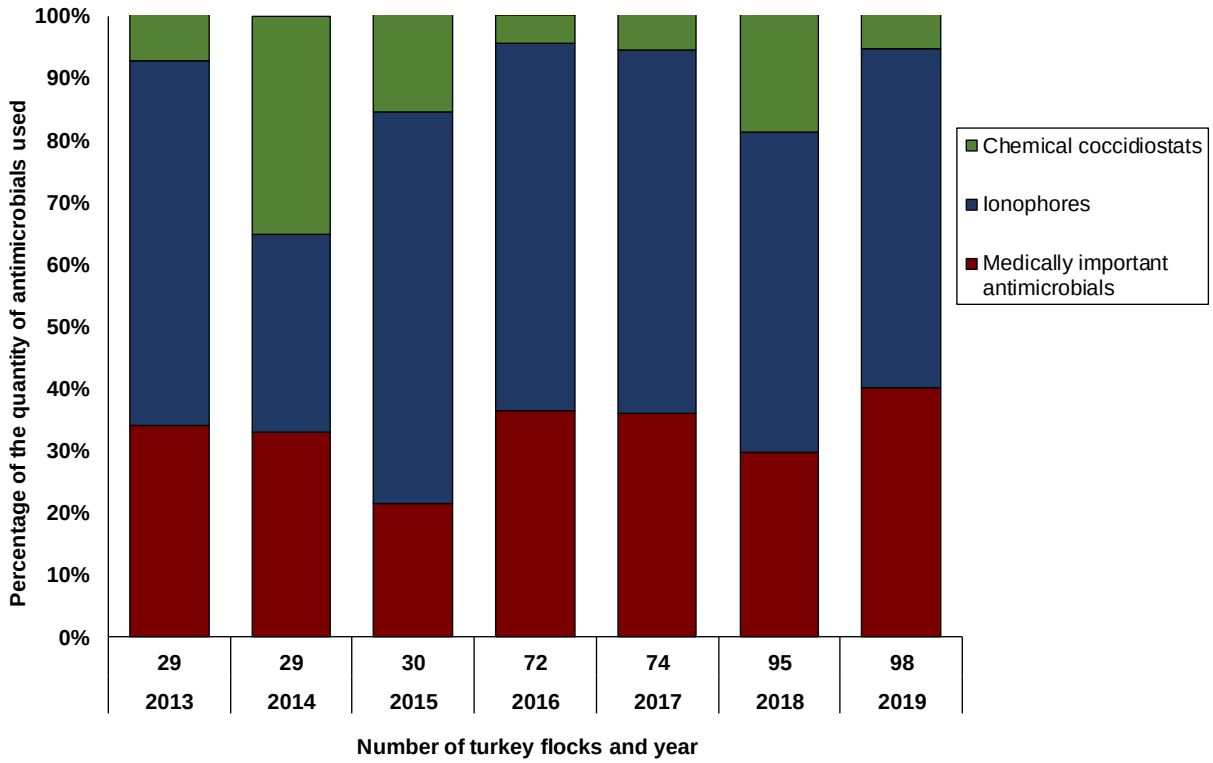


Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Antimicrobial															
II Gentamicin	0.13	0.14	0.14	0.01	0	0.01	0	0.13	0.09	0.01	0	0.11	0.11	0.02	0
Total	**0.13**	**0.14**	**0.14**	**0.01**	**0**	**0.01**	**0**	**0.13**	**0.09**	**0.01**	**0**	**0.11**	**0.11**	**0.02**	**0**

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 per day (mg_{drug}/kg_{animal}/day); please refer to 2019 CIPARS Design and Methods, Table A. 1 for the list of standards.
nDDDvetCA/1,000 turkey-days at risk = number of DDDvetCA/1,000 turkey-days at risk.
For detailed indicator descriptions, please refer to the CIPARS 2019: Design and Methods document.

Coccidiostat and antiprotozoal use in feed by frequency

Figure 2. 16 Percentage of the quantity (milligrams of active ingredient) of antimicrobials used in turkey flocks, 2013 to 2019

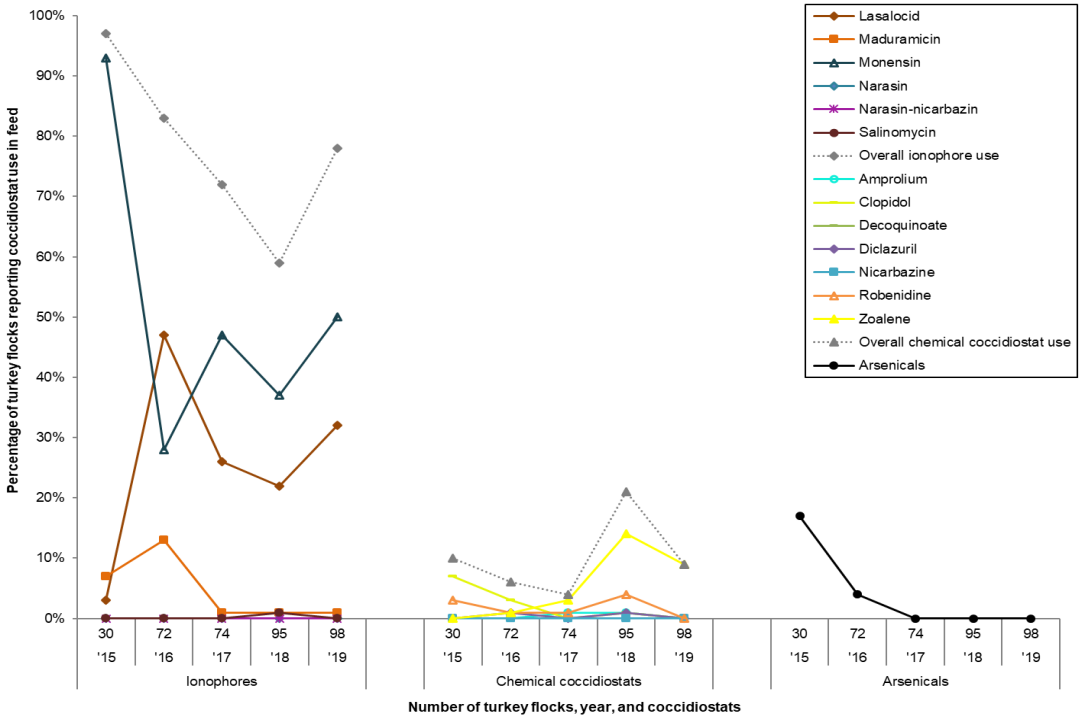


Year Number of flocks	2013 29	2014 29	2015 30	2016 72	2017 74	2018 95	2019 98
Antimicrobial classification							
Medically important antimicrobials[1]	34%	33%	22%	37%	36%	30%	40%
Ionophores	59%	32%	63%	59%	59%	52%	55%
Chemical coccidiostats	8%	35%	17%	5%	6%	19%	9%

Quantity of antimicrobials in milligrams active ingredients.
[1] Medically-important antimicrobials are the classes reported in the previous section[7] .

[7] Government of Canada. Health Canada, Veterinary Drugs Directorate. List A: List of certain antimicrobial active pharmaceutical ingredients. Available at: https://www.canada.ca/en/public-health/services/antibiotic-antimicrobial-resistance/animals/veterinary-antimicrobial-sales-reporting/list-a.html.

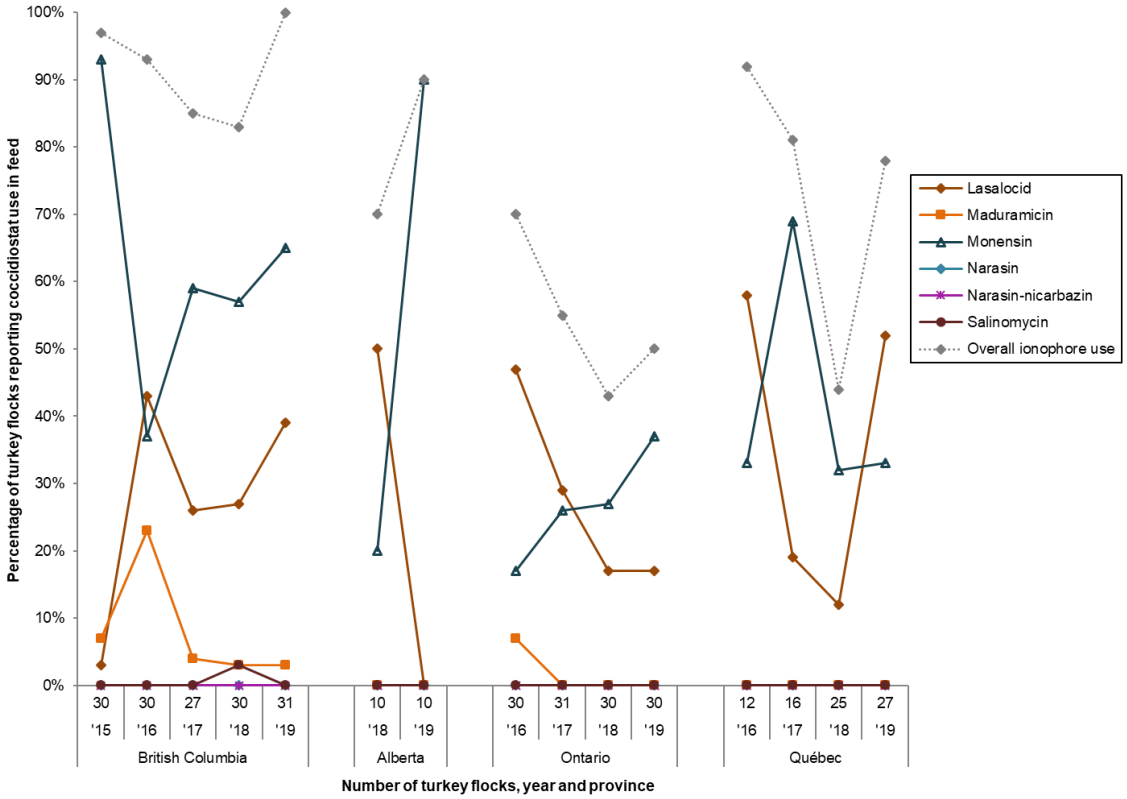
Figure 2. 17 Percentage of turkey flocks reporting coccidiostats and other antiprotozoals use in feed, 2015 to 2019



Year Number of flocks		2015 30	2016 72	2017 74	2018 95	2019 98
Coccidiostat						
IV	Lasalocid	3%	**47%**	26%	**22%**	**32%**
IV	Maduramicin	7%	**13%**	1%	**1%**	**1%**
IV	Monensin	93%	**28%**	47%	**37%**	**50%**
IV	Narasin	0%	**0%**	0%	**0%**	**0%**
IV	Narasin-nicarbazin	0%	**0%**	0%	**0%**	**0%**
IV	Salinomycin	0%	**0%**	0%	**1%**	**0%**
IV	**Overall ionophore use**	97%	**83%**	72%	**59%**	**78%**
N/A	Amprolium	0%	**0%**	1%	**1%**	**0%**
N/A	Clopidol	7%	**3%**	0%	**1%**	**0%**
N/A	Decoquinoate	0%	**0%**	0%	**0%**	**0%**
N/A	Diclazuril	0%	**1%**	0%	**1%**	**0%**
N/A	Nicarbazine	0%	**0%**	0%	**0%**	**0%**
N/A	Robenidine	3%	**1%**	1%	**4%**	**0%**
N/A	Zoalene	0%	**1%**	3%	**14%**	**9%**
N/A	**Overall chemical coccidiostat use**	10%	**6%**	4%	**21%**	**9%**
N/A	**Arsenicals**	17%	**4%**	0%	**0%**	**0%**

Roman numeral IV indicates category of importance to human medicine as outlined by the Veterinary Drugs Directorate. N/A = not applicable (no classification at the time of writing of this report).
For the temporal analyses, the proportion (%) of flocks using a specific coccidiostat in the current year has been compared to the proportion (%) of flocks using the same coccidiostat in 2016 (national program started) and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences ($P \leq 0.05$) for a given coccidiostat.

Figure 2. 18 Percentage of turkey flocks reporting ionophore coccidiostats use in feed, by province, 2015 to 2019

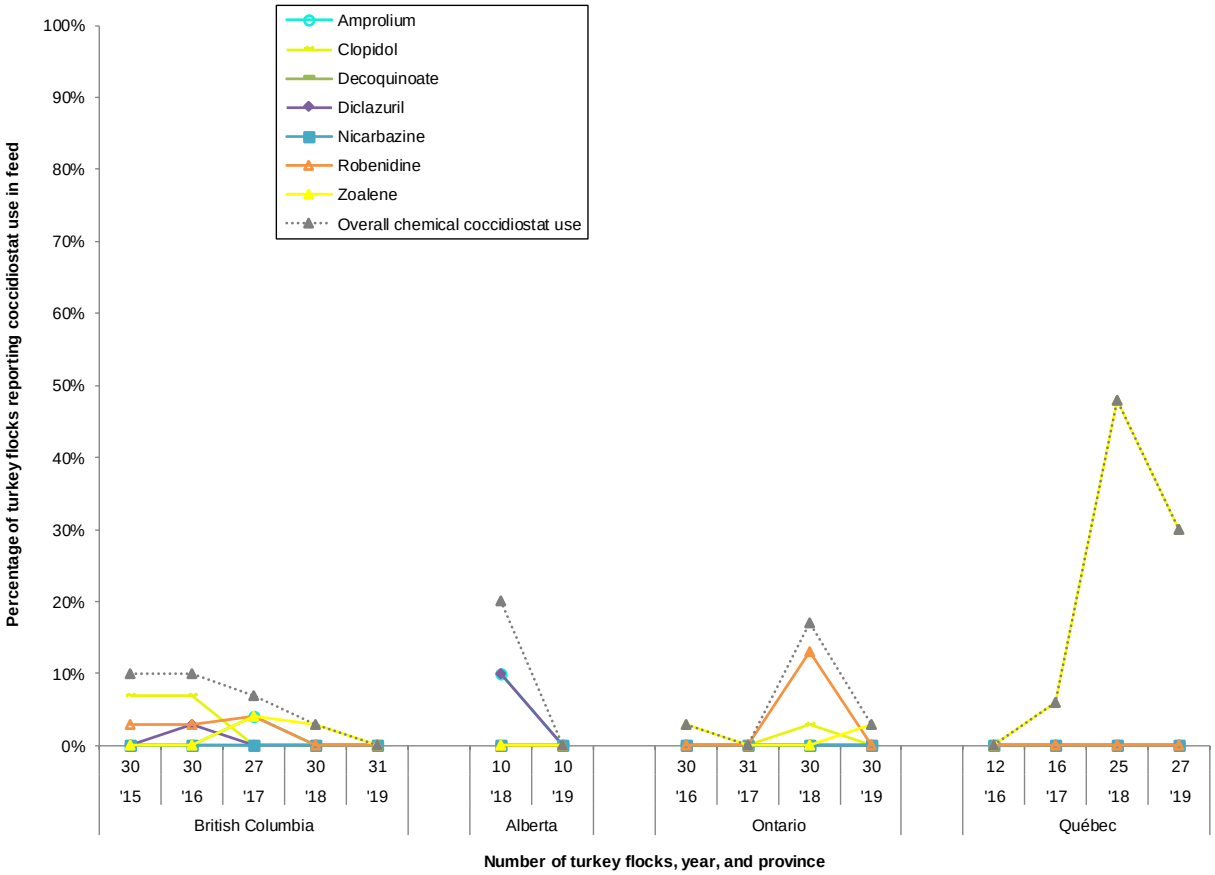


Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Coccidiostat															
IV Lasalocid	3%	**43%**	26%	**27%**	**39%**	**50%**	**0%**	**47%**	29%	**17%**	**17%**	**58%**	19%	**12%**	**52%**
IV Maduramicin	7%	**23%**	4%	**3%**	**3%**	**0%**	**0%**	**7%**	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**
IV Monensin	93%	**37%**	59%	**57%**	**65%**	**20%**	**90%**	**17%**	26%	**27%**	**37%**	**33%**	69%	**32%**	**33%**
IV Narasin	0%	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**
IV Narasin-nicarbazin	0%	**0%**	0%	**0%**	**0%**	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**
IV Salinomycin	0%	**0%**	0%	**3%**	**0%**	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**
IV **Overall ionophores use**	**97%**	**93%**	**85%**	**83%**	**100%**	**70%**	**90%**	**70%**	**55%**	**43%**	**50%**	**92%**	**81%**	**44%**	**78%**

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

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

Figure 2. 19 Percentage of turkey flocks reporting chemical coccidiostats and other antiprotozoals use in feed, by province, 2015 to 2019



Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of flocks	30	30	27	30	31	10	10	30	31	30	30	12	16	25	27
Coccidiostat															
N/A – Amprolium	0%	0%	4%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%
N/A – Clopidol	7%	7%	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%	0%	0%
N/A – Decoquinoate	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
N/A – Diclazuril	0%	3%	0%	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%
N/A – Nicarbazine	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
N/A – Robenidine	3%	3%	4%	0%	0%	0%	0%	0%	0%	13%	0%	0%	0%	0%	0%
N/A – Zoalene	0%	0%	4%	3%	0%	0%	0%	3%	0%	0%	3%	0%	6%	48%	30%
Overall chemical coccidiostat use	10%	10%	7%	3%	0%	20%	0%	3%	0%	17%	3%	0%	6%	48%	30%

N/A = not applicable (no classification at the time of writing of this report).
For the temporal analyses within province, the proportion (%) of flocks using a specific chemical coccidiostat in the current year has been compared to the proportion (%) of flocks using the same chemical coccidiostat in 2016 (national program started) and the previous surveillance year (grey areas). The presence of blue areas indicates significant temporal differences within province ($P \leq 0.05$) for a given chemical coccidiostat. The presence of red areas indicates significant provincial differences ($P \leq 0.05$) for a given chemical coccidiostat within the current year (Québec-referent province).

Chapter 3 Antimicrobial Resistance

Key findings

Salmonella (n = 301)

- Similar to 2018, the top 3 *Salmonella* serovars were Uganda, Reading and Heidelberg (Table 3. 1). Gentamicin resistance significantly decreased by 5% from the previous year and resistance was detected in Ontario and Québec (Figure 3. 1). There were 10 isolates resistant to 4 to 5 classes of antimicrobials (7 Reading from Alberta, 2 Hadar from British Columbia, and 1 Indiana from Ontario). It is important to note that 3 Infantis isolates exhibited resistance to 6 to 7 classes of antimicrobials (Table 3. 1).
- There were 5 isolates that exhibited resistance to ceftriaxone (3 Infantis and 1 Indiana from Ontario and 1 Heidelberg from Québec), 3 isolates that exhibited resistance to ciprofloxacin (Reading from British Columbia) and 8 isolates that exhibited resistance to nalidixic acid (5 Reading from British Columbia and 3 Infantis from Ontario).
- No isolates exhibited resistance to meropenem (Table 3. 1).

Escherichia coli (n = 393)

- Six isolates were resistant to ceftriaxone (from British Columbia, Alberta and Québec), 1 isolate was resistant to ciprofloxacin (Ontario), and 8 isolates were resistant to nalidixic acid (detected from all provinces sampled) (Table 3. 2).
- Overall, resistance to gentamicin decreased by 3% and the decrease was observed in British Columbia and Alberta (Figure 3. 2).
- Resistance to meropenem was not detected in any of the isolates.

Campylobacter (n = 214)

- Thirty six percent (78/214) of the isolates were resistant to ciprofloxacin (Table 3. 3). The proportion of ciprofloxacin resistant isolates decreased in British Columbia (61% to 59%), but it increased in Ontario (22% to 25%) and Québec (8% to 26%) between 2018 and 2019 (Figure 3. 3).
- Resistance to azithromycin and erythromycin were detected from 10 isolates from Ontario and Québec (Table 3. 3).

Multiclass resistance

Table 3. 1 Number of antimicrobial classes in resistance patterns of *Salmonella* from turkeys, 2019

Province / 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	40 (46.0)	19	16	5				6	11					4				3	5	4
Uganda	26 (29.9)	16		10				10						10						10
Hadar	11 (12.6)			9	2			11	4					2						11
Agona	6 (6.9)	5		1			1	1						1						1
Less common serovars	4 (4.6)	4																		
Total	**87 (100)**	**44**	**16**	**25**	**2**		**1**	**28**	**15**					**17**				**3**	**5**	**26**
Alberta																				
Reading	14 (45.1)	2	4	1	7			8	11					8						8
Heidelberg	5 (16.1)	3	1	1			1		1											1
Schwarzengrund	4 (12.9)	1		3				3						3						3
Hadar	3 (9.7)			3				3												3
Mbandaka	3 (9.7)	3																		
Cubana	1 (3.2)	1																		
London	1 (3.2)	1																		
Total	**31 (100)**	**11**	**5**	**8**	**7**		**1**	**14**	**12**					**11**						**15**
Ontario																				
Uganda	45 (45.0)	5	1	39				40						39						39
Reading	13 (13.0)	13																		
Schwarzengrund	9 (9.0)	9																		
Muenchen	6 (6.0)	4		2				2						2						2
Senftenberg	4 (4.0)	4																		
Typhimurium	4 (4.0)	4																		
Berta	3 (3.0)	3																		
Infantis	3 (3.0)					3		3	3		3			3			3		3	3
Anatum	2 (2.0)	2																		
Hadar	2 (2.0)			2				2												2
Livingston	2 (2.0)		2																	2
Muenster	2 (2.0)	2																		
Tennessee	2 (2.0)	1	1					1												
Less common serovars	3 (3.0)	1		1	1			2	1	1	1	1		2	1		1			1
Total	**100 (100)**	**48**	**4**	**44**	**1**	**3**		**50**	**4**	**1**	**4**	**1**		**46**	**1**		**4**		**3**	**49**
Québec																				
Heidelberg	28 (33.7)	20	3	5				7	6	1	1	1								
Uganda	28 (33.7)	10		18				18						18						18
Hadar	9 (10.8)	1	1	7				7	5											7
Schwarzengrund	9 (10.8)	5		4				4						4						4
Muenchen	6 (7.2)	4		2				2						2						2
Senftenberg	2 (2.4)	2																		
Reading	1 (1.2)	1																		
Total	**83 (100)**	**43**	**4**	**36**				**38**	**11**	**1**	**1**	**1**		**24**						**31**
National																				
Uganda	99 (32.9)	31	1	67				68						67						67
Reading	68 (22.6)	35	20	6	7			14	22					12				3	5	12
Heidelberg	33 (11.0)	23	4	6			1	7	7	1	1	1								1
Hadar	25 (8.3)	1	1	21	2			23	9					2						23
Schwarzengrund	22 (7.3)	15		7				7						7						7
Muenchen	12 (4.0)	8		4				4						4						4
Seftenberg	7 (2.3)	7																		
Less common serovars	35 (11.6)	26	3	2	1	3	1	7	4	1	4	1		6	1		4		3	7
Total	**301 (100)**	**146**	**29**	**113**	**10**	**3**	**2**	**130**	**42**	**2**	**5**	**2**		**98**	**1**		**4**	**3**	**8**	**121**

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. 2 Number of antimicrobial classes in resistance patterns of *Escherichia coli* from turkeys, 2019

Province	Number (%) of isolates	Number of isolates by number of antimicrobial classes in the resistance pattern					Number of isolates resistant by antimicrobial class and antimicrobial											
							Aminoglycosides		β-Lactams					Folate pathway 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	124 (31.5)	36	28	45	15		19	54	34	2	2	3		27	7		5		3	71
Alberta	40 (10.2)	4	12	16	8		4	18	21	4	3	3		11	2		1		2	32
Ontario	118 (30.0)	35	28	41	14		10	41	26					33	11		6	1	2	72
Québec	111 (28.2)	34	20	46	11		9	39	33	1	1	1		31	20		2		1	66
National	**393 (100)**	**109**	**88**	**148**	**48**		**42**	**152**	**114**	**7**	**6**	**7**		**102**	**40**		**14**	**1**	**8**	**241**

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.

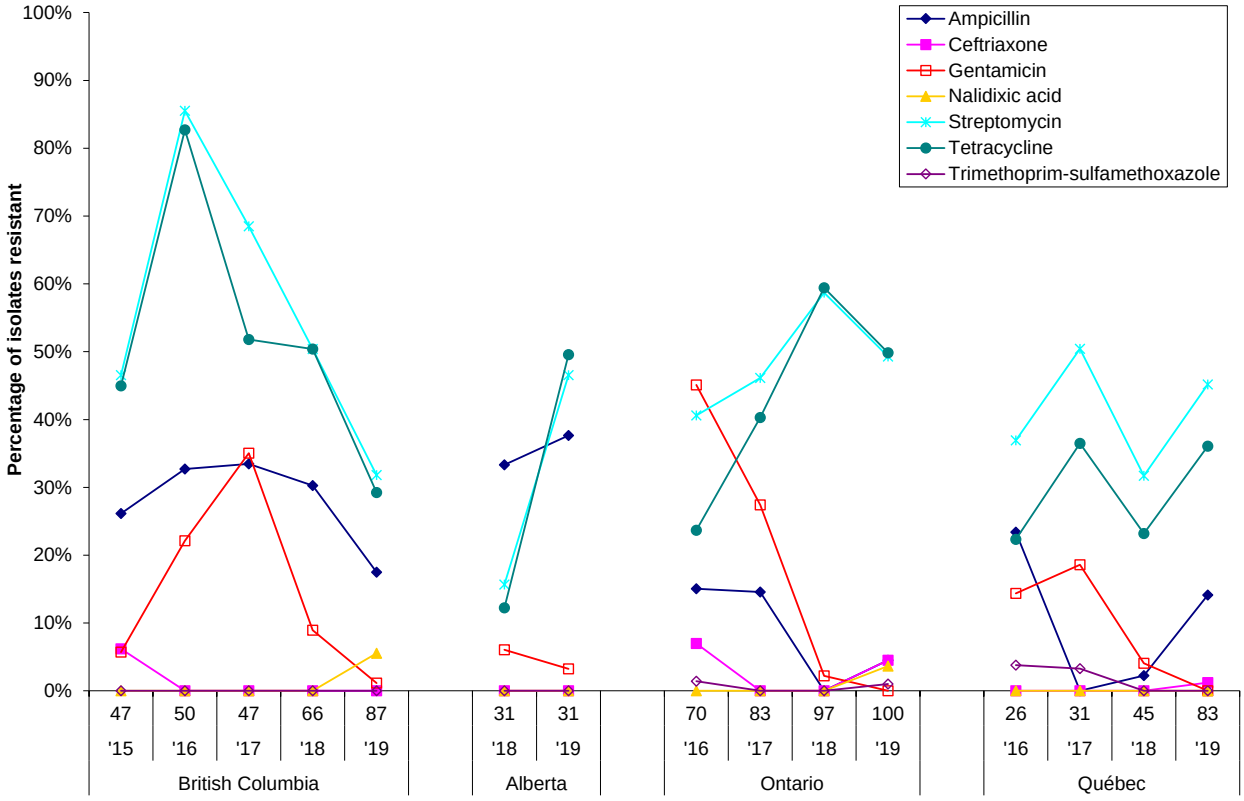
Table 3. 3 Number of antimicrobial classes in resistance patterns of *Campylobacter* from turkeys, 2019

Province / 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	Lincosamides	Macrolides		Phenicols	Quinolones		Tetracyclines
		0	1	2–3	4–5	6–7	GEN	CLI	AZM	ERY	FLR	CIP	NAL	TET
British Columbia														
Campylobacter coli	29 (33.7)	2	13	14								23	22	18
Campylobacter jejuni	57 (66.3)	24	15	18								28	28	23
Total	**86 (100)**	**26**	**28**	**32**								**51**	**50**	**41**
Alberta														
Campylobacter coli	8 (40.0)	8												
Campylobacter jejuni	12 (60.0)	12												
Total	**20 (100)**	**20**												
Ontario														
Campylobacter coli	14 (25.5)	11	2	1				1	1	1				2
Campylobacter jejuni	32 (58.1)	12	15	5								5	5	20
Campylobacter spp.	9 (16.4)	1	8									8	8	
Total	**55 (100)**	**24**	**25**	**6**				**1**	**1**	**1**		**13**	**13**	**22**
Québec														
Campylobacter coli	9 (16.9)		1	8				8	9	9				
Campylobacter jejuni	44 (83.0)	15	15	14								14	14	29
Total	**53 (100)**	**15**	**16**	**22**				**8**	**9**	**9**		**14**	**14**	**29**
National														
Campylobacter coli	60 (28.0)	21	16	23				9	10	10		23	22	20
Campylobacter jejuni	145 (67.8)	63	45	37								47	47	72
Campylobacter spp.	9 (4.2)	1	8									8	8	
Total	**214 (100)**	**85**	**69**	**60**				**9**	**10**	**10**		**78**	**77**	**92**

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.

Temporal antimicrobial resistance summary

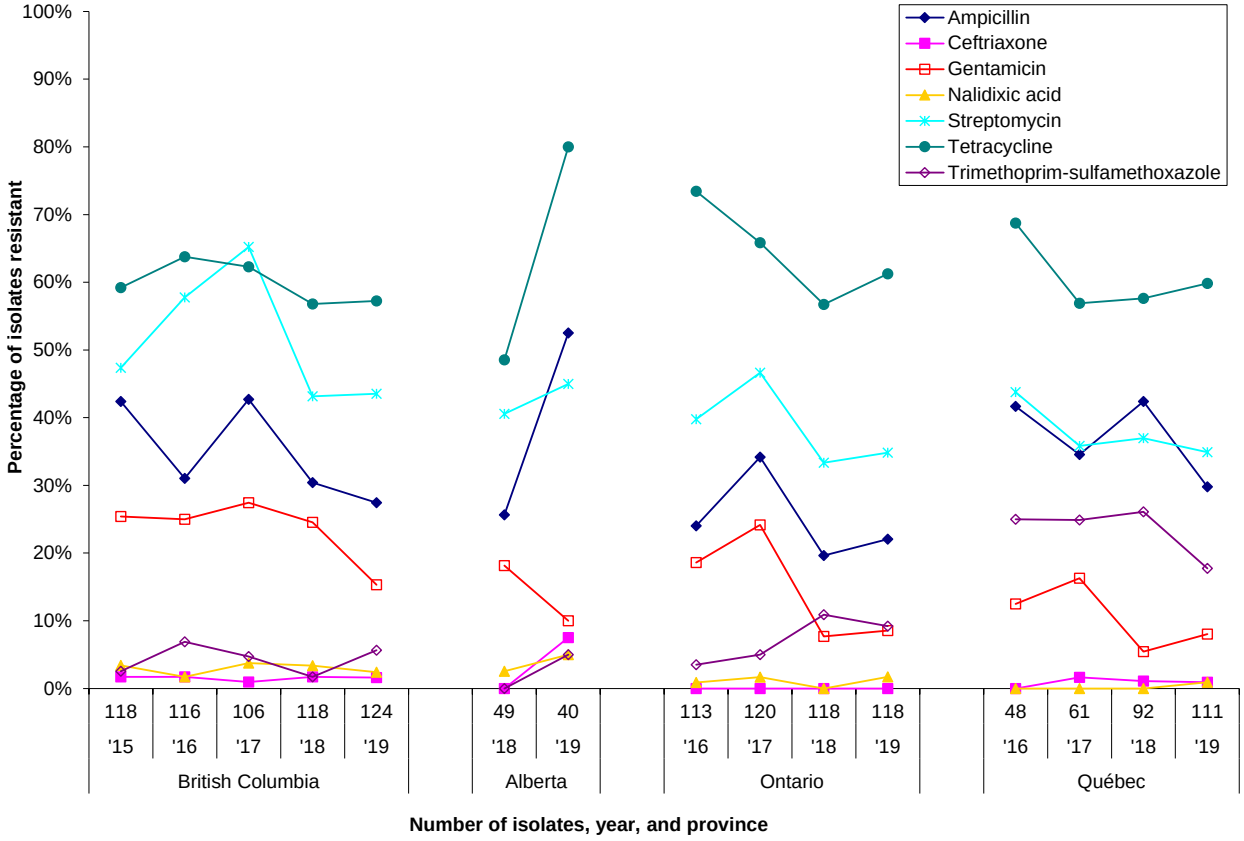
Figure 3. 1 Temporal variations in resistance of *Salmonella* isolates from turkeys at pre-harvest, 2015 to 2019



Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of isolates	47	50	47	66	87	31	31	70	83	97	100	26	31	45	'20
Antimicrobial															
Ampicillin	**26%**	33%	33%	**30%**	**17%**	**33%**	**38%**	**15%**	15%	**0%**	**5%**	**23%**	0%	**2%**	**14%**
Ceftriaxone	**6%**	0%	0%	**0%**	**0%**	**0%**	**0%**	**7%**	0%	**0%**	**5%**	**0%**	0%	**0%**	**1%**
Gentamicin	**6%**	22%	35%	**9%**	**1%**	**6%**	**3%**	**45%**	27%	**2%**	**0%**	**14%**	19%	**4%**	**0%**
Nalidixic acid	**0%**	0%	0%	**0%**	**6%**	**0%**	**0%**	**0%**	0%	**0%**	**4%**	**0%**	0%	**0%**	**0%**
Streptomycin	**47%**	86%	69%	**50%**	**32%**	**16%**	**47%**	**41%**	46%	**59%**	**49%**	**37%**	50%	**32%**	**45%**
Tetracycline	**45%**	83%	52%	**50%**	**29%**	**12%**	**50%**	**24%**	40%	**59%**	**50%**	**22%**	36%	**23%**	**36%**
Trimethoprim-sulfamethoxazole	**0%**	0%	0%	**0%**	**0%**	**0%**	**0%**	**1%**	0%	**0%**	**1%**	**4%**	3%	**0%**	**0%**

For the temporal analyses by province, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years, or the first surveillance year, and the preceding surveillance year (grey areas). The presence of blue areas indicate significant differences ($P \leq 0.05$) for a given province and antimicrobial.
The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

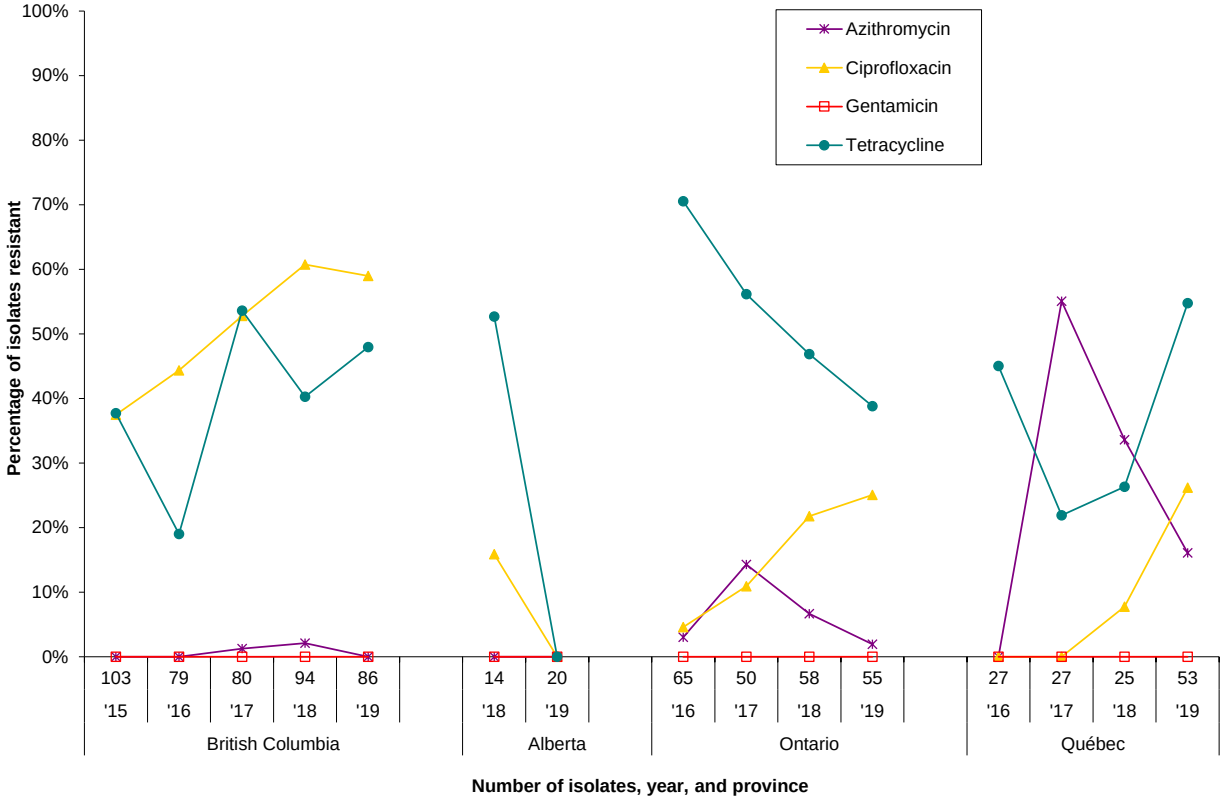
Figure 3. 2 Temporal variations in resistance of *Escherichia coli* isolates from turkeys at pre-harvest, 2015 to 2019



Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of isolates	118	116	106	118	124	49	40	113	120	118	118	48	61	92	111
Antimicrobial															
Ampicillin	**42%**	31%	43%	**30%**	**27%**	**26%**	**52%**	**24%**	34%	**20%**	**22%**	**42%**	35%	**42%**	**30%**
Ceftriaxone	**2%**	2%	1%	**2%**	**2%**	**0%**	**8%**	**0%**	0%	**0%**	**0%**	**0%**	2%	**1%**	**1%**
Gentamicin	**25%**	25%	27%	**25%**	**15%**	**18%**	**10%**	**19%**	24%	**8%**	**9%**	**12%**	16%	**5%**	**8%**
Nalidixic acid	**3%**	2%	4%	**3%**	**2%**	**3%**	**5%**	**1%**	2%	**0%**	**2%**	**0%**	0%	**0%**	**1%**
Streptomycin	**47%**	58%	65%	**43%**	**44%**	**41%**	**45%**	**40%**	47%	**33%**	**35%**	**44%**	36%	**37%**	**35%**
Tetracycline	**59%**	64%	62%	**57%**	**57%**	**49%**	**80%**	**73%**	66%	**57%**	**61%**	**69%**	57%	**58%**	**60%**
Trimethoprim-sulfamethoxazole	**3%**	7%	5%	**2%**	**6%**	**0%**	**5%**	**4%**	5%	**11%**	**9%**	**25%**	25%	**26%**	**18%**

For the temporal analyses by province, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years, or the first surveillance year, and the preceding surveillance year (grey areas). The presence of blue areas indicate significant differences ($P \leq 0.05$) for a given province and antimicrobial.
The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

Figure 3. 3 Temporal variations in resistance of *Campylobacter* isolates from turkeys at pre-harvest, 2015 to 2019



Province	British Columbia					Alberta		Ontario				Québec			
Year	'15	'16	'17	'18	'19	'18	'19	'16	'17	'18	'19	'16	'17	'18	'19
Number of isolates	103	79	80	94	86	14	20	65	50	58	55	27	27	25	53
Antimicrobial															
Azithromycin	**0%**	0%	1%	**2%**	**0%**	**0%**	**0%**	**3%**	14%	**7%**	**2%**	**0%**	55%	**34%**	**16%**
Ciprofloxacin	**37%**	44%	53%	**61%**	**59%**	**16%**	**0%**	**5%**	11%	**22%**	**25%**	**0%**	0%	**8%**	**26%**
Gentamicin	**0%**	0%	0%	**0%**	**0%**	**0%**	**0%**	**0%**	0%	**0%**	**0%**	**0%**	0%	**0%**	**0%**
Tetracycline	**38%**	19%	54%	**40%**	**48%**	**53%**	**0%**	**71%**	56%	**47%**	**39%**	**45%**	22%	**26%**	**55%**

For the temporal analyses by province, the proportion (%) of isolates resistant to a specific antimicrobial over the current year has been compared to the proportion (%) of isolates resistant to the same antimicrobial during the previous 5 years, or the first surveillance year, and the preceding surveillance year (grey areas). The presence of blue areas indicate significant differences ($P \leq 0.05$) for a given province and antimicrobial.
The proportion of resistant isolates for all antimicrobials was adjusted to account for multiple samples per flock.

Recovery results

Table 3. 4 Farm Surveillance recovery rates in turkeys, 2016 to 2019

Animal species	Province	Year	Percentage (%) of isolates recovered and number of isolates recovered / number of samples submitted							
			Escherichia coli		*Salmonella*		*Campylobacter*		*Enterococcus*	
Turkeys	British Columbia	2016	**100%**	116/116	**43%**	50/116	**68%**	79/116		
		2017	**98%**	106/108	**44%**	47/108	**75%**	80/108		
		2018	**99%**	118/119	**55%**	66/119	**79%**	94/119		
		2019	**100%**	124/124	**70%**	87/124	**70%**	87/124		
	Alberta	2018	**98%**	39/40	**78%**	31/40	**35%**	14/40		
		2019	**100%**	40/40	**78%**	31/40	**50%**	20/40		
	Ontario	2016	**97%**	113/116	**60%**	70/116	**56%**	65/116		
		2017	**100%**	120/120	**69%**	83/120	**42%**	50/120		
		2018	**98%**	118/120	**81%**	97/120	**48%**	58/120		
		2019	**98%**	118/120	**83%**	100/120	**46%**	55/120		
	Québec	2016	**100%**	48/48	**54%**	26/48	**56%**	27/48		
		2017	**95%**	61/64	**48%**	31/64	**42%**	27/64		
		2018	**100%**	92/92	**49%**	45/92	**27%**	25/92		
		2019	**97%**	111/115	**72%**	83/115	**46%**	53/115		
	National	2016	**99%**	277/280	**52%**	146/280	**61%**	171/280		
		2017	**98%**	287/292	**55%**	161/292	**54%**	157/292		
		2018	**99%**	367/371	**64%**	239/371	**51%**	191/371		
		2019	**98%**	393/399	**75%**	301/399	**54%**	215/399		

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).

Appendix

Abbreviations

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
TET Tetracycline
TIO Ceftiofur