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CANADIAN INTEGRATED PROGRAM FOR ANTIMICROBIAL RESISTANCE SURVEILLANCE (CIPARS) ANNUAL REPORT

CHAPTER 3
ANTIMICROBIAL USE IN ANIMALS

Canada

TO PROMOTE AND PROTECT THE HEALTH OF CANADIANS THROUGH LEADERSHIP, PARTNERSHIP, INNOVATION AND ACTION IN PUBLIC HEALTH.

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FARM SURVEILLANCE IN GROWER-FINISHER PIGS

- Agriculture and Agri-Food Canada
- Alberta Agriculture and Rural Development
- Canadian Pork Council and Provincial Pork Boards
- CIPARS Farm Swine Advisory Committee
- Participating veterinarians and producers

FARM SURVEILLANCE IN BROILER CHICKENS

- Alberta Agriculture
- 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
- Participating veterinarians and producers.
- Saskatchewan Agriculture

QUANTITIES OF ANTIMICROBIALS DISTRIBUTED FOR SALE FOR USE IN ANIMALS

We would like to sincerely thank the Canadian Animal Health Institute and their member companies for voluntarily providing the quantities of antimicrobials distributed for sale for use in animals in Canada. We would also like to thank ImpactVet for many ideas for reporting format.

CIPARS would also like to thank the small group of volunteer industry and provincial representatives who have been participating in active discussions on appropriate denominators for quantities of antimicrobials distributed for use in animals.

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PREAMBLE

ABOUT CIPARS

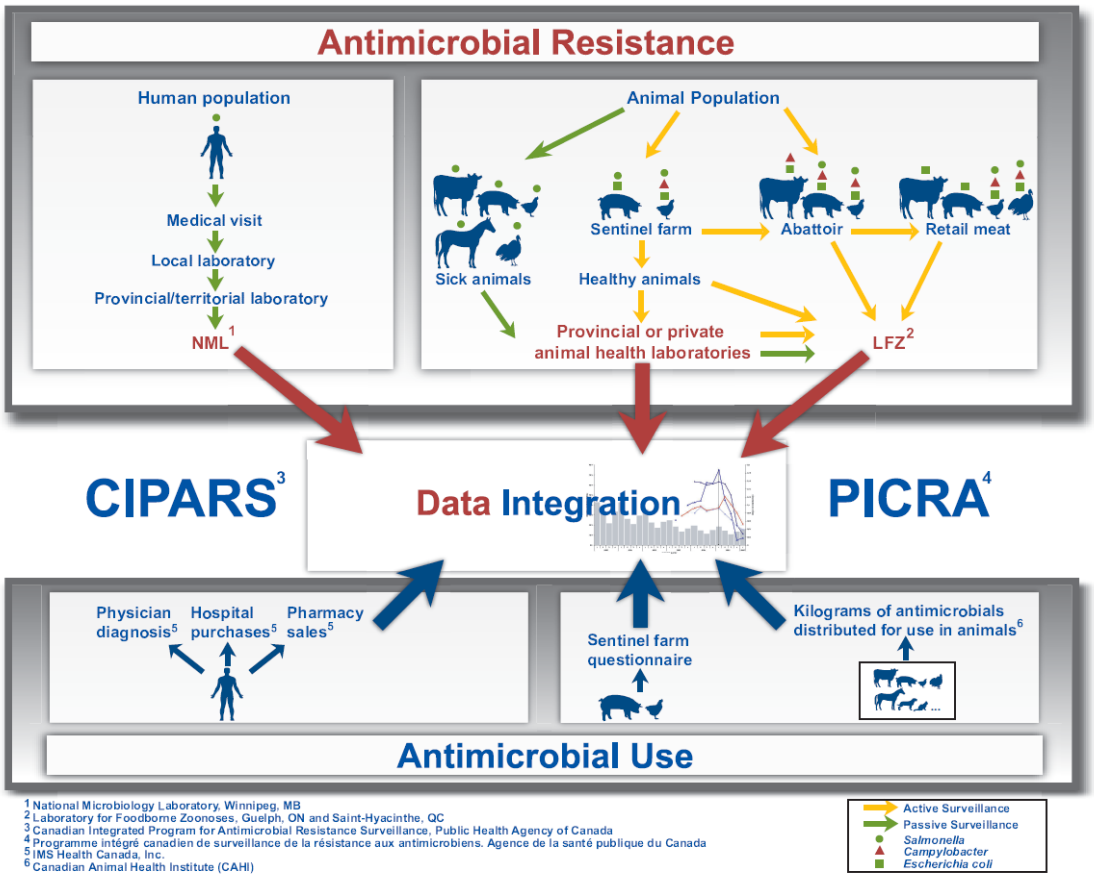
The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS), created in 2002, is a national program dedicated to the collection, integration, analysis, and communication of trends in antimicrobial use (AMU) and resistance (AMR) in selected bacteria from humans, animals, and animal-derived food sources across Canada. This information supports (i) the creation of evidence-based policies for AMU in hospitals, communities, and food-animal production with the aim of prolonging the effectiveness of these drugs and (ii) the identification of appropriate measures to contain the emergence and spread of resistant bacteria among animals, food, and people.

During 2012, CIPARS held discussions on alternative methods of analyzing and presenting the surveillance data to adjust for different data closure dates, and to maximize the integration of existing data. The Annual Report will be released in a Chapter format to improve the timeliness of the data publications. The Annual Report will consist of 4 chapters: Chapter 1—Design and Methods, Chapter 2—Antimicrobial Resistance, Chapter 3—Antimicrobial Use In Animals, and Chapter 4—Integrated Findings and Discussion. Chapter 1 includes detailed information on the design and methods used by CIPARS to obtain and analyze the AMR and AMU data, including summary tables describing changes that have been implemented since the beginning of the program. Chapters 2 and 3 present results for AMR and AMU, respectively, with each table including a section on the top key findings. Chapter 4 brings together some of the results across surveillance components, over time, across regions, and across host/bacterial species.

CIPARS SURVEILLANCE COMPONENTS AND DATA SOURCES

The current components and data sources for CIPARS are assembled together for analysis and reporting as shown in Figure 1. The top half of the figure includes the antimicrobial resistance components and the antimicrobial use components of CIPARS are along the bottom of the figure.

Figure 1. Diagram of CIPARS surveillance components, 2013



HOW TO READ THIS CHAPTER

This chapter highlights the most notable antimicrobial use findings across the animal surveillance components of CIPARS for 2013. These findings are presented by component (farm–broiler chickens, farm–grower-finisher pigs, quantities of antimicrobials distributed for sale for use in animals). For the 2 *Farm Surveillance* components, information about the farm demographics, animal health and biosecurity are also presented to provide context and possible reasons for antimicrobial use. Further integration of these findings across the antimicrobial use components and human antimicrobial use and with the antimicrobial resistance data is presented in the 2013 Annual Report, Chapter 4—Integrated Findings and Discussion.

PRESENTATION OF ANTIMICROBIAL USE DATA

The antimicrobial use data collected on farm (broiler chicken and grower-finisher pigs) is largely presented by antimicrobial (active ingredient) except in the feed sections where some figures and tables are presented by antimicrobial class. The *Farm Surveillance* data are reported as both qualitative antimicrobial use metrics (e.g., number of farms reporting using an antimicrobial), as well as quantitative antimicrobial (active ingredient) use metrics (e.g., median g/1,000 pig-days).

Summary antimicrobial use data in feed are presented in Table 1.4 for broiler chickens and in Table 2.3 for grower-finisher pigs. These tables provide key antimicrobial use data including the number and percent of flocks/herds exposed to each listed antimicrobial (active ingredient), the number and percent of rations that contained each antimicrobial, the median number of days the herd/flock was fed the antimicrobial (days exposed), the percent of the flocks/herds that were exposed to the antimicrobial, the median concentration of the antimicrobial in the feed (g/tonne), the rate of antimicrobial consumption (g/1,000 chicken-days or pig-days). For more information about how antimicrobial use data are collected and analysed, see the 2013 Annual Report, Chapter 1—Design and Methods.

For the antimicrobial distribution data provided by the Canadian Animal Health Institute (CAHI), the data are aggregated by CAHI according to accounting rules and are provided in antimicrobial categories/classes. The CAHI data are reported as quantitative information (e.g., kilograms of active ingredient or as milligrams of active ingredient/population correction unit).

For many of the tables and figures in this chapter, individual antimicrobials are categorized based on their importance in human medicine are determined by Health Canada's Veterinary

Drugs Directorate[3]: Category I—Very high importance, Category II—High importance, Category III—Medium importance, Category IV—Low importance.

TEMPORAL FIGURES AND DATA TABLES FOR SIGNIFICANCE TESTING

All temporal figures and accompanying data tables presented in this chapter for the *Farm Surveillance* components depict the variation in antimicrobial use since the year surveillance was implemented or a significant change was made in the data collection; this is 2009 for grower-finisher pigs and 2013 for broiler chickens. For consistency across the farm components, statistical analyses were limited to comparison of 2013 results with: 1) 2012 results and 2) the first year of surveillance.

To facilitate the assessment of significant results at a glance, all significant differences found have been highlighted in blue (or underlined) in data tables underneath the temporal figures. Finally, for all statistical analyses, a *P*-value less or equal to 0.05 was used to indicate a significant difference between years. All statistically significant results are marked by the use of the word "significant" or "significantly" in the text. All other findings presented without this word should be considered as non-statistically significant and should be interpreted with caution.

BACKGROUND INFORMATION

FARM—BROILER CHICKENS

A total of 99 farms across 4 poultry producing provinces (British Columbia, Alberta, Ontario, and Québec) participated in the CIPARS Broiler *Farm Surveillance* program in 2013. Ninety-nine chick placement and 97 pre-harvest questionnaires were received. The sampling and data collection in broiler farms commenced in April 2013 and covered 6 quota periods (A-116 to A-121). Eleven poultry veterinary practices conducted the survey and collected samples associated with the flock visit (placement or pre-harvest). Detailed methods are discussed in the 2013 CIPARS Annual Report, Chapter 1—Design and Methods.

The overall capacity of the 99 sentinel farms was 7.4 million birds at 1 grow-out period; overall contribution to national production was approximately 8%. The chicks placed in these farms were from 16 major commercial broiler hatcheries in the 4 provinces (Canadian Hatcheries Federation members). A proportion of chicks in 8 flocks were from imported sources. The mean age at pre-harvest sampling was 34 days and mean body weight was 2.02 kg. Table 1.6 summarizes the farm level demographics of the 99 farms included in the survey.

[3] Version April, 2009. Available at: www.hc-sc.gc.ca/dhp-mps/vet/antimicrob/amr_ram_hum-med-rev-eng.php. Accessed September 2014.

FARM—GROWER-FINISHER PIGS

Data for this chapter were collected from sentinel swine farms through questionnaires administered by the herd veterinarian (or designated staff) to the producer (or designated farm staff). The questionnaires collected data on antimicrobial use (AMU), herd demographics, and animal health—antimicrobial use data pertain only to the grow-finish phase of production. Please refer to the 2013 Annual Report, Chapter 1—Design and Methods for additional information regarding data collection and analysis.

Over the 5-year period from 2009 to 2013, 454 questionnaires were received from 136 sentinel swine farms, with 39% of farms (53/136) reporting in each of the 5 years. In 2013, questionnaires were submitted from 89 sentinel farms by 20 veterinarians, contributing 20% (89/454) of the total number of questionnaires to the data presented in this chapter.

In 2013, questionnaires were received from 17 herds in Alberta (19%, 17/89), 13 in Saskatchewan (15%, 13/89), 8 in Manitoba (9%, 8/89), 28 in Ontario (31%, 28/89) and 23 in Québec (26%, 23/89).

In 2013, 60% of farms (53/89) reported owning their own breeding sows; 45% (40/89) kept sows on-site and 15% (13/89) had sows off-site. Thirty-one percent (28/89) of farms reported that they purchased pigs from a single source while 9% (8/89) purchased pigs from multiple sources.

Fifty-two percent of farms (46/89) reported being all-in-all-out operations and 48% of farms (43/89) indicated operating as a continuous flow system.

QUANTITIES OF ANTIMICROBIALS DISTRIBUTED FOR SALE FOR USE IN ANIMALS

As an estimate of the quantities of licensed antimicrobials used in animals, data on active ingredients distributed for sale were aggregated and provided to the Public Health Agency of Canada by the Canadian Animal Health Institute (CAHI). CAHI is the trade association representing the companies that manufacture and distribute drugs for administration to food (including fish), sporting, and companion animals in Canada. The association estimates that its members' sales represent over 90% of all sales of licensed animal pharmaceutical products in Canada[4]. The CAHI data provide a measure of antimicrobials distributed for sale for use in all animal species, including those not covered by CIPARS farm-level surveillance

The CAHI data do not include antimicrobials imported under the personal-use provision of the federal Food and Drugs Act Regulations (own use import—OUI), nor do they include imported active pharmaceutical ingredients (API), which are drugs imported in non-dosage form and used by a licensed pharmacist or veterinarian. The latest information from CAHI is that the lost opportunity value due to OUI and API was estimated to be 13% of total of all animal health product sales of its members. Health Canada's Veterinary Drugs Directorate is currently reviewing these importation processes as part of their regulatory modernization discussions to enable appropriate oversight. The CAHI data also do not include prescriptions filled by

[4] Available at: http://cahi-icsa.ca/about/

pharmacists using human labeled drugs for companion animals. Hence, distribution data should always be considered with other sources of information (such as farm-level surveillance and antimicrobial resistance findings) for any decision-making. Strong caution should be applied with making inferences with the CAHI to any use practice for a particular animal species. As stated in the United Kingdom's surveillance report on antimicrobials sold for use in animals[5], the population is an important denominator, as the greater the number of animals, the greater the potential need for antimicrobial therapy. A standard weight was used for each production class to determine the biomass of the animal population; the population correction unit (PCU). However, a static standard weight may not reflect an industry shift in production affecting the average weights of animals treated, related to weather, trade, or other reasons.

Distribution data in broad categories, whether adjusted for populations and weights or not, cannot account for the individual potencies of the antimicrobials administered to different species; this has implications for interpretations in trends over time. For example, a decrease in the kilograms of antimicrobials distributed (with or without adjustment by population) reported for a given year could potentially reflect a switch to using a more potent drug, as opposed to reflecting a decrease in the actual exposure of animals to antimicrobials.

Stratification of the data by province was available for 2011 through to 2013. Stratification of the data by companion animal/production animal was available for 2012 and 2013.

Please see the 2013 CIPARS Annual Report, Chapter 1—Design and Methods for a more in-depth description of these data and information regarding how the adjustment for populations and weights (PCU) was calculated.

CIPARS continues to work to improve this measure and other appropriate measures, to best reflect antimicrobial use in the Canadian context.

[5] 2012. UK Veterinary Antibiotic Resistance and Sales Surveillance Report. Veterinary Medicines Directorate - Government Department for the Environment, Food and Rural Affairs. UK-VARSS Available at: www.vmd.defra.gov.uk/pdf/VARSS.pdf. Accessed March 2014.

ABBREVIATIONS

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

DISEASES

APP *Actinobacillus pleuropneumoniae*

PCVAD Porcine circovirus associated disease

PRRS Porcine reproductive and respiratory syndrome

TGE Transmissible gastroenteritis

OTHER

CMIB Compendium of Medicating Ingredients Brochure

CVP Compendium of Veterinary Products

G/TPD Gram per 1,000 pig-days

VDD Veterinary Drugs Directorate, Health Canada

SUMMARY—THE TOP KEY FINDINGS

Farm Surveillance

Broiler Chickens

- In broiler flocks, exposure through feed represented the greatest antimicrobial exposure (93%, 90/97).
- Ceftiofur, a third generation cephalosporin and enrofloxacin, a fluoroquinolone were the only Category I (Very high importance to human medicine) antimicrobials used. Ceftiofur was applied in embryonating eggs or hatched chicks at the hatchery in 31% (31/99) of flocks, and enrofloxacin, reported used in limited number of flocks (2/97) on farm. The use of both drugs was prior to a voluntary change by the industry to eliminate the preventive use of antimicrobials that are considered of very high importance to human medicine.
- Overall, disease prevention was the most frequently reported primary reason for use: 1) Hatchery-level uses aimed to prevent neonatal diseases (i.e., yolk sacculitis and septicemia primarily) and 2) Feed use aimed to prevent 2 economically significant broiler enteric diseases: necrotic enteritis caused by *Clostridium perfringens* and coccidiosis caused by various species of *Eimeria*. These enteric diseases were rarely diagnosed in the field due to their subclinical nature and prevented largely by antimicrobials in feed.

Farm Surveillance

Grower-Finisher Pigs

- The frequency of antimicrobial exposure through feed (77%) was the greatest compared to that by injection (61%) or in water (26%).
- Antimicrobials administered by injection are administered to < 5% of pigs, whereas 100% of pigs are exposed, generally, when administration is through feed or water.
- The most common reason for antimicrobial use in feed was for disease prevention (51%), followed by growth promotion (41%) and disease treatment (8%).
- The antimicrobials used in the greatest quantity in feed were chlortetracycline (758 median grams per 1,000 pig-days (g/TPD), tilmicosin (451 g/TPD), lincomycin (98 g/TPD), sulfamethazine (166 g/TPD) and salinomycin (61 g/TPD).
- Antimicrobials were most commonly used for *Streptococcus suis*, *E. coli*, and *Mycoplasma* in nurseries, and *Streptococcus suis*, *Mycoplasma*, and *Lawsonia* in grower-finisher herds.

Quantities of Antimicrobials Distributed for Sale for Use in Animals

- In 2013, 1.5 million kilograms of antimicrobials were distributed for sale by the Canadian Animal Health Institute (CAHI) member companies for use in animals; a decrease of 16% relative to the 2006 total and a decrease of 9% relative to the 2012 total; 24% were in Category IV; considered of low importance to human medicine (ionophores and chemical coccidiostats).
- The quantity of fluoroquinolones distributed for use in animals in 2013 decreased by 21% relative to the 2006 total and increased by 15% relative to the 2012 total (based on kg active ingredient).
- There were provincial differences between the quantities of antimicrobials distributed for sale and differences within provinces in the quantities distributed between years.
- In 2013, the quantity of antimicrobials distributed for use in companion animals represented 0.2% of the total antimicrobials distributed for sale (ionophores and chemical coccidiostats included).
- The quantity of antimicrobials distributed adjusted for animal populations and weights in 2013 increased by 2% since 2006 (in comparison to the 2006 total) and increased by 1% in comparison to the 2012 total.

1. FARM SURVEILLANCE—BROILER CHICKENS

KEY FINDINGS

- Information obtained through placement and pre-harvest questionnaires from the 99 broiler chicken flocks from 99 unique sentinel farms represented a cross-section of hatcheries, chick source (e.g., domestic and a few flocks with imported chicks mixed), production type, farm size, and breed/genetics (Table 1.6 and Table 1.7); sample and data were collected over 6 quota periods.
- Exposure through feed represented the greatest exposure (93%, 90/97) in grown broilers (Table 1.1) compared to flocks exposed via injection at the hatchery (*in ovo* ie., in the egg or subcutaneous) (58%, 57/99) or water (7%, 7/97). At the hatchery, ceftiofur, a third-generation cephalosporin was the only Veterinary Drugs Directorate (VDD) Category I antimicrobial reported; it was administered through *in ovo* or subcutaneous route in 31% of flocks (31/99).
- During the grow-out period, enrofloxacin, a fluoroquinolone, was the only Veterinary Drugs Directorate (VDD) Category I antimicrobial reported; it was administered through water.
- No Category I antimicrobial was used in feed. Among the 99 flocks surveyed, the most commonly used antimicrobials by all routes of administration included bacitracin (47%, 47/99), virginiamycin (45%, 45/99), and salinomycin (35%, 35/99; a ionophore) (Table 1.2). These were all antimicrobials administered via the feed.
- Eight flocks (8%, 8/99) reported no use of antimicrobials, by any route of administration (Table 1.1). These were flocks raised as organic, antimicrobial-free, and conventional flocks that were fed unmedicated rations.

ADMINISTRATION *IN OVO* OR SUBCUTANEOUS INJECTION

- Three antimicrobials were reported to be used at the hatchery level via *in ovo* or subcutaneous injection: ceftiofur (31%, 31/99), gentamicin (3%, 3/99), and lincomycin-spectinomycin (24%, 24/99) (Table 1.3).
- Provincial/regional differences in antimicrobial use options for hatchery-level administration were observed. Ceftiofur was used in British Columbia (58%, 15/26), Alberta (53%, 8/15) and Québec (29%, 8/28) flocks. No ceftiofur use was reported in Ontario flocks. Gentamicin was used only in British Columbia (12%, 3/26). Lincomycin-spectinomycin was used in Ontario (17%, 5/30) and Québec (68%, 19/28) flocks, but was not used in British Columbia and Alberta (Figure 1.1) flocks.

- Across all the provinces surveyed, the primary reason for use indicated for all antimicrobials was mainly for disease prevention and not for disease treatment since diagnosis could not be made at the time of hatchery medication; gross lesions are typically detected post-hatch. Other categories such as high risk breeder flock source (i.e., based on performance of chicks hatched previously from the specific breeders or current disease pressure) and producer request were deemed preventive use (Figure 1.2). Avian pathogenic *E. coli* was the most frequently targeted pathogen for preventive use of any antimicrobials at the hatchery (Figure 1.3).

ADMINISTRATION IN FEED

- Overall, the number of flocks reporting antimicrobial use in feed was 93% (90/97); the antimicrobials used belong to VDD Categories II to IV. No VDD Category I antimicrobials were used in feed (Table 1.2).
- Provincial variations in antimicrobial use options were observed (Figure 1.4), but the following antimicrobial classes were used across the 4 provinces: streptogramins, bacitracins, ionophores, and chemical coccidiostats.
- Disease prevention was the most frequently reported reasons for antimicrobial use (93%, 90/97 flocks) (Figure 1.5). Antimicrobials were used to prevent 2 main broiler diseases of economic significance such as necrotic enteritis caused by *Clostridium perfringens* (macrolides, penicillins, streptogramins, and bacitracins) and coccidiosis, caused by *Eimeria* spp. (ionophores and chemical coccidiostats) (Figure 1.6).
- Sixteen percent (16/97) of flocks reported antimicrobial use for disease treatment. Trimethoprim-sulfadiazine was the most frequently used (15%, 15/97) and also deemed extra-label. It was used for treating yolksacculitis, septicemia in young flocks, and musculoskeletal diseases in older flocks. A veterinary prescription was provided for the use of this antimicrobial. Only 1 flock reported the use of oxytetracycline for the treatment of musculoskeletal diseases (Figure 1.7). These 2 antimicrobials also had the highest inclusion rate per tonne of feed reported and total grams of active ingredient per 1,000 chicken-days compared to antimicrobials routinely used for prevention and growth promotion.

- Twelve percent (12/97) of flocks reported growth promotion[6,7] as the primary reason for use used antimicrobials for production purposes (Figure 1.5). The antimicrobial reported under growth promotion were bacitracin, virginiamycin, penicillin, and bambermycin; however, only 3 of these flocks reported inclusion rates consistent with growth promotion. The inclusion rates reported for bacitracin and virginiamycin were for non growth promotion purposes. For bacitracin, 8/8 flocks used 55 g/tonne, the preventive dose for necrotic enteritis, and 4/6 flocks used a higher dose of 110 g/tonne; this dose is indicated for the prevention of early chick mortality due to diminished feed consumption and chilling per Compendium of Medicating Ingredients Brochure (CMIB) and Compendium of Veterinary Products (CVP)[8] (Table 1.4). For virginiamycin, 5/5 flocks used 22 g/tonne, the preventive dose for necrotic enteritis infections, and only 1 out of these 5 flocks lowered the dose to 11 g/tonne at the end of grow; this dose is indicated for increased rate of weight gain and feed efficiency as per CMIB and CVP. Only 3 flocks reported the use of the latter antimicrobials: penicillin in 2 flocks (33 g/tonne) and bambermycin in 1 flock (2 g/tonne).

ADMINISTRATION IN WATER

- Only 7% (7/97) of broiler flocks reported the use of antimicrobials via the drinking water; some flocks reported use of more than 1 antimicrobial (Figure 1.10). These were equally used for disease prevention or treatment (Figure 1.11).
- Four different antimicrobials/antimicrobial combinations were used.
- Enrofloxacin administered via the drinking water was the only Category I antimicrobial used but a very limited number of flocks reported usage (2%, 2/97). This was for the treatment of yolksacculitis (Figure 1.13). A veterinary prescription was provided.
- Other antimicrobials used included penicillin and the sulfonamides (sulfaquinoxaline and sulfaquinoxaline-pyrimethamine) (Figure 1.12 and Figure 1.13). The sulfonamides had the highest grams per 1,000 chicken-days compared to the other antimicrobials (Table 1.5). Prescription was provided in all cases of treatment in drinking water except in 2 flocks which reported use of antimicrobials via over-the-counter purchase (penicillin and sulfaquinoxaline).

[6] Shryock TR and Page SW. 2013. Performance uses of antimicrobial agents and non-antimicrobial alternatives. In: Giguère S, Prescott JF, and Dowling T (ed). Antimicrobial therapy in veterinary medicine, 5th edition. Wiley-Blackwell pp. 379-394.

[7] Canadian Food Inspection Agency. Compendium of Medicating Ingredients Brochure. Available at: www.inspection.gc.ca/animals/feeds/medicating-ingredients/eng/1300212600464/1320602461227. Accessed January 2015.

[8] Compendium of Veterinary Products. Available at: bam.naccvp.com/?u=country&p=msds. Accessed January 2015.

SUMMARY OF ANTIMICROBIAL USE BY ROUTE OF ADMINISTRATION

Table 1.1. Number of broiler flocks with reported antimicrobial use by route of administration, 2013

Antimicrobial use	Route of Administration			
	Any route[a] n (%)	*In-ovo* /subcutaneous n (%)	Feed n (%)	Water n (%)
Any antimicrobial use	91 (92)	57 (58)	90 (93)	7 (7)
No antimicrobial use	8 (8)	42 (42)	7 (7)	90 (93)
Total flocks	**99 (100)**	**99 (100)**	**97 (100)**	**97 (100)**

Two flocks were sampled at placement but were not sampled at pre-harvest (no feed and water data).

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

Table 1.2. Number of broiler flocks with reported use of antimicrobial by route of administration, 2013

	Antimicrobial class	Antimicrobial	Route of administration			
			Any route n (%)	*In-ovo* /SC n (%)	Feed n (%)	Water n (%)
I	Third generation cephalosporins	Ceftiofur	31 (31)	31 (31)	0 (0)	0 (0)
	Fluoroquinolone	Enrofloxacin	2 (2)	0 (0)	0 (0)	2 (2)
II	Aminoglycosides	Gentamicin	3 (3)	3 (3)	0 (0)	0 (0)
	Lincosamides-aminocyclitols	Lincomycin-spectinomycin	24 (24)	24 (24)	0 (0)	0 (0)
	Macrolides	Tylosin	7 (7)	0 (0)	7 (7)	0 (0)
	Penicillins	Penicillin G potassium	4 (4)	0 (0)	0 (0)	4 (4)
		Penicillin G procaine	12 (12)	0 (0)	12 (12)	0 (0)
	Streptogramins	Virginiamycin	45 (45)	0 (0)	45 (46)	0 (0)
	Trimethoprim-sulfonamides	Trimethoprim-sulfadiazine	15 (15)	0 (0)	15 (15)	0 (0)
III	Bacitracins	Bacitracin	47 (47)	0 (0)	47 (48)	0 (0)
	Sulfonamides	Sulfaquinoxaline	1 (1)	0 (0)	0 (0)	1 (1)
		Sulfaquinoxaline-pyrimethamine	2 (2)	0 (0)	0 (0)	2 (2)
	Tetracyclines	Oxytetracycline	1 (1)	0 (0)	1 (1)	0 (0)
IV	Flavophospholipids	Bambermycin	1 (1)	0 (0)	1 (1)	0 (0)
	Ionophores	Lasalocid	10 (10)	0 (0)	10 (10)	0 (0)
		Maduramicin	0 (0)	0 (0)	0 (0)	0 (0)
		Monensin	28 (28)	0 (0)	28 (29)	0 (0)
		Narasin	21 (21)	0 (0)	21 (22)	0 (0)
		Narasin-nicarbazin	30 (30)	0 (0)	30 (31)	0 (0)
		Salinomycin	35 (35)	0 (0)	35 (36)	0 (0)
N/A	Chemical coccidiostats	Clopidol	11 (11)	0 (0)	11 (11)	0 (0)
		Diclazuril	7 (7)	0 (0)	7 (7)	0 (0)
		Nicarbazin	34 (34)	0 (0)	34 (35)	0 (0)
		Zoalene	3 (3)	0 (0)	3 (3)	0 (0)

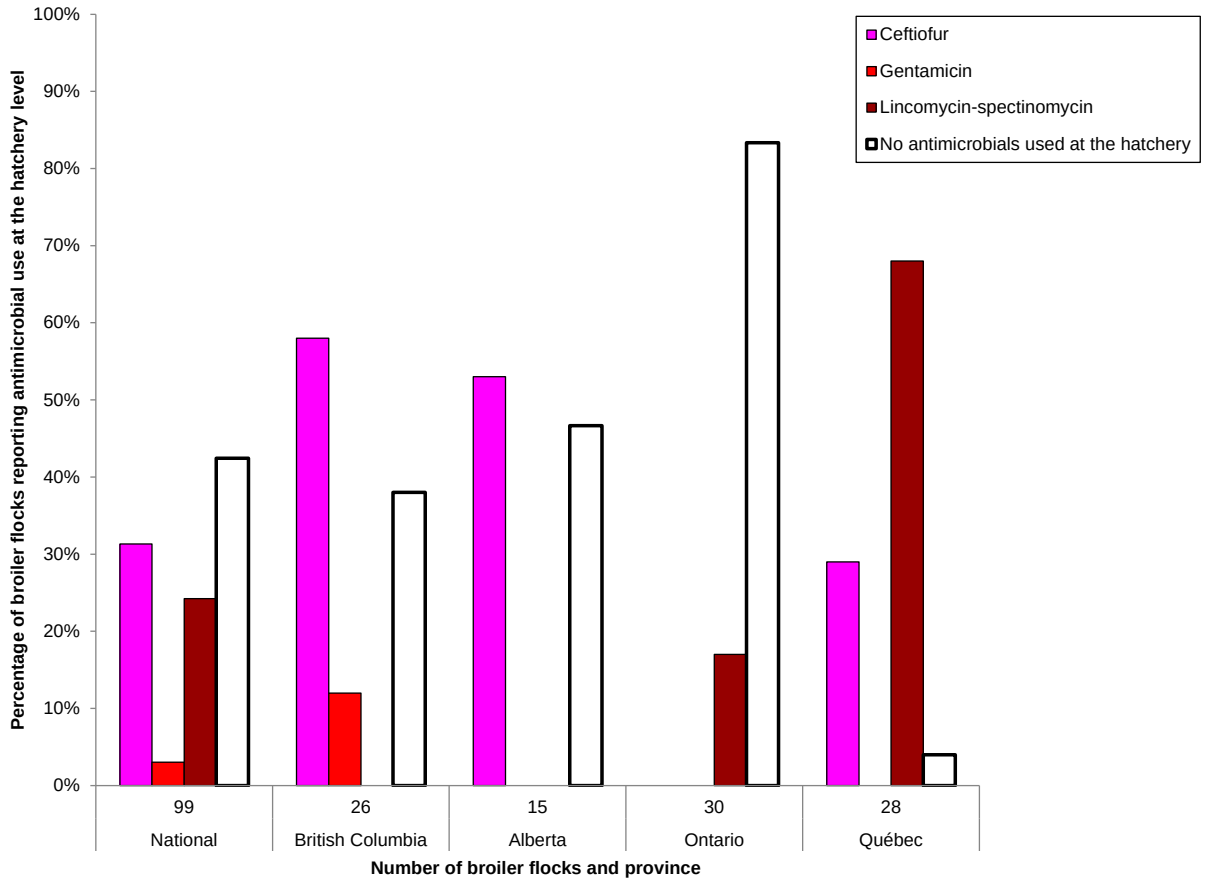
Roman numerals I to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

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

SC=subcutaneous route of injection.

ANTIMICROBIAL USE *IN OVO* OR SUBCUTANEOUS INJECTION

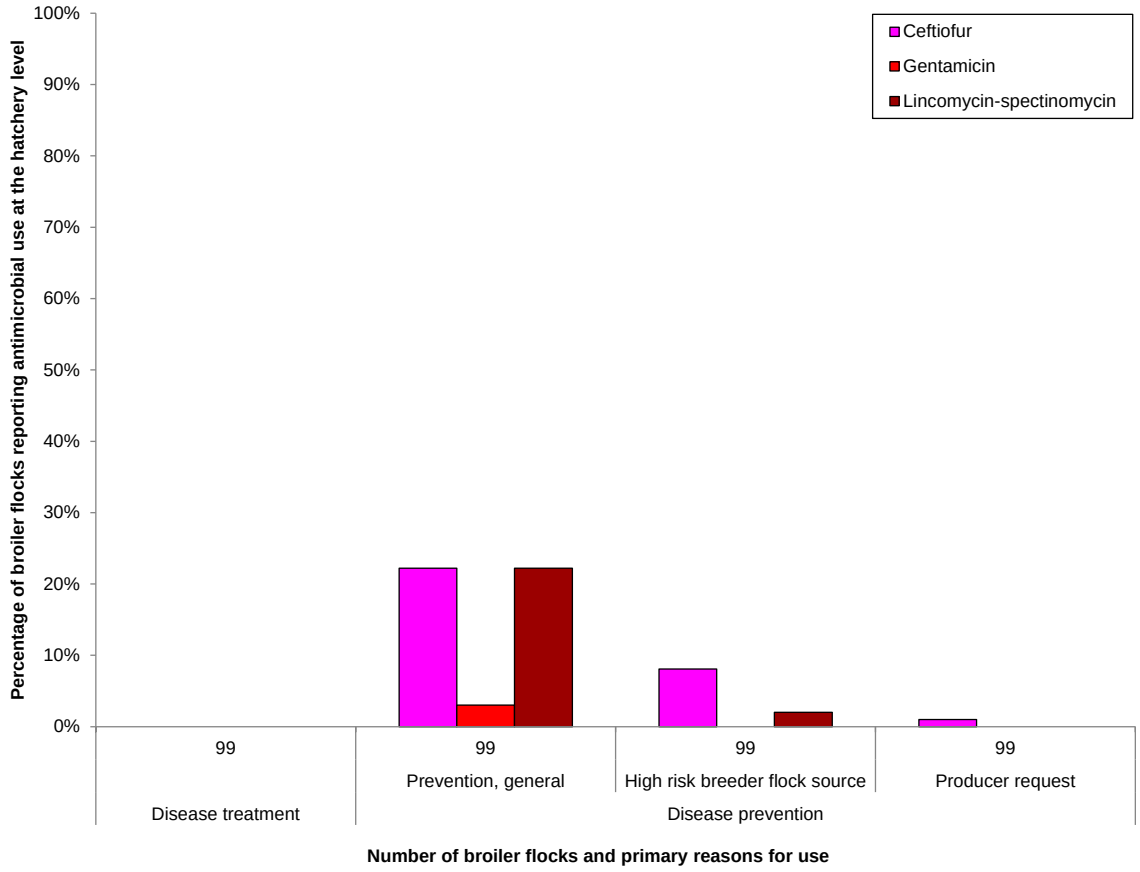
Figure 1.1. Percentage of broiler flocks reporting antimicrobial use *in ovo* or subcutaneous injection at the hatchery level by province, 2013



Province Number of flocks		National 99	British Columbia 26	Alberta 15	Ontario 30	Québec 28
Antimicrobial						
I	Ceftiofur	31%	58%	53%	0%	29%
II	Gentamicin	3%	12%	0%	0%	0%
	Lincomycin-spectinomycin	24%	0%	0%	17%	68%
	No antimicrobials used at the hatchery	42%	38%	47%	83%	4%

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) have used more than 1 antimicrobial.
Data represent flocks medicated at the hatchery at day 18 of incubation or upon hatch.

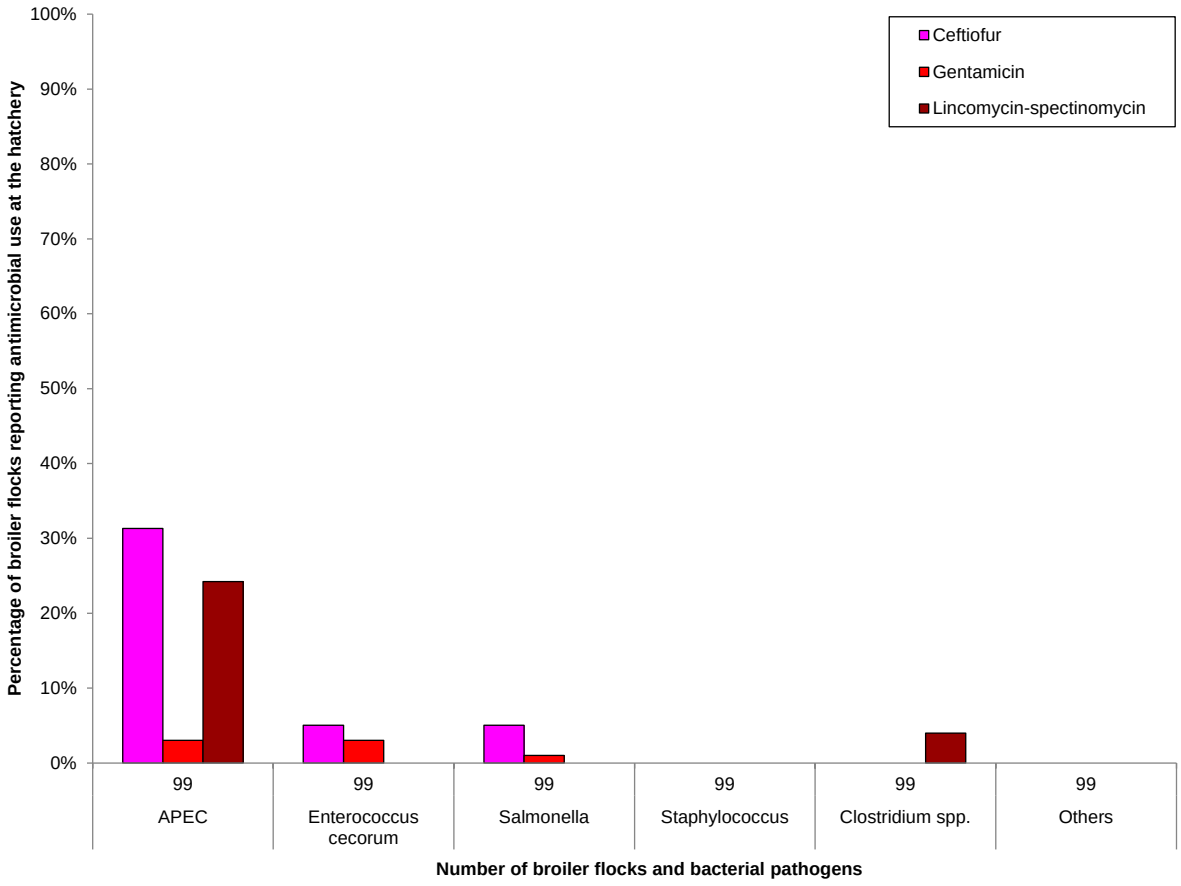
Figure 1.2. Percentage of broiler flocks reporting antimicrobial use *in ovo* or subcutaneous injection at the hatchery by primary reason, 2013



Primary reasons for use		Disease treatment	Disease prevention		
Subcategories			Prevention, general	High risk breeder flock source	Producer request
Number of flocks		99	99	99	99
Antimicrobial					
I	Ceftiofur	0%	22%	8%	1%
II	Gentamicin	0%	3%	0%	0%
	Lincomycin-spectinomycin	0%	22%	2%	0%

Roman numerals I to II indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Respondents were instructed to select only one of "Disease treatment", "Disease prevention", "High risk breeder flock source" (i.e., hatching eggs from old flocks that may have poor shell quality; any disease pressure, infectious or metabolic, in the breeder flocks resulting to poor shell quality) as a primary reason for use of an antimicrobial. High risk breeder flock source and producer request were deemed preventive reasons for use.

Figure 1.3. Percentage of broiler flocks reporting antimicrobial use *in ovo* or subcutaneous injection at the hatchery for *Disease prevention*, 2013



Primary reasons for use		Disease prevention					
Bacterial pathogens		APEC	*Enterococcus cecorum*	*Salmonella*	*Staphylococcus*	*Clostridium* spp.	Others
Number of flocks		99	99	99	99	99	99
Antimicrobial							
I	Ceftiofur	31%	5%	5%	0%	0%	0%
II	Gentamicin	3%	3%	1%	0%	0%	0%
	Lincomycin-spectinomycin	24%	0%	0%	0%	4%	0%

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

The respondents were instructed to select all potential pathogens affecting chicks post-hatch as diagnosis cannot be made at the time of hatchery medication; lesions typically seen post-hatch.

APEC=Avian pathogenic *E. coli* (responsible for yolksacculitis and neonatal septicemia).

Lincomycin-spectinomycin was largely used for prevention except in 1 flock that reported use of this antimicrobial for treatment.

Table 1.3. Summary of antimicrobial use administered *in ovo* or subcutaneous injection at the hatchery, 2013

	Antimicrobial	Flocks n (%)	Days Exposed median (min. ; max.)	Dose (mg) per egg/chick median (min. ; max.)[a,b,c]
I	Ceftiofur	31 (31%)	N/A	0.17 (0.05 ; 0.20)
II	Gentamicin	3 (3%)	N/A	0.20 (0.20 ; 0.20)
	Lincomycin-spectinomycin	24 (24%)	N/A	0.75 (0.75 ; 0.75)

Roman numerals I to II indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
N/A=not applicable (these were administered only once).

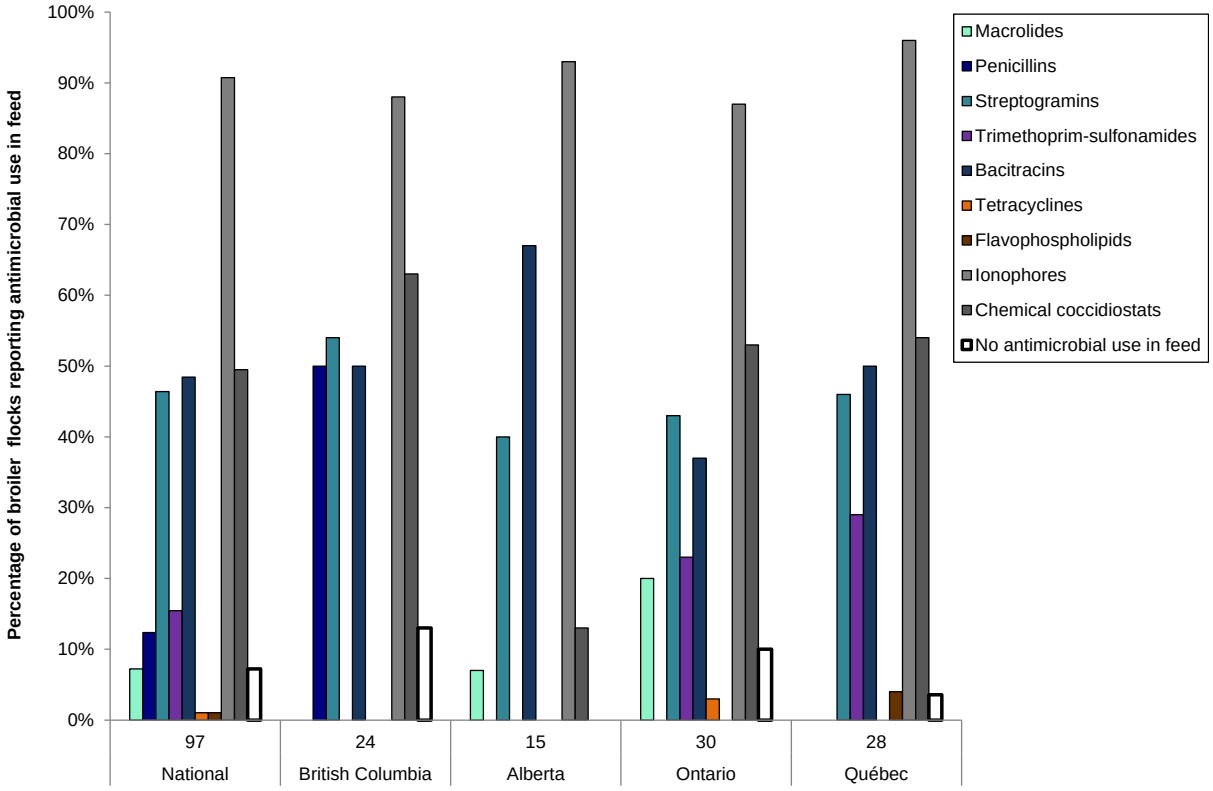
[a] Doses used for *in ovo* applications in hatching eggs at day 18 of incubation or subcutaneous applications in chicks at day of hatch.

[b] Median use estimates are based on flocks that used the specified antimicrobial in mg per hatching egg or chick.

[c] Doses reported were based on milligrams per egg or chick suggested by the manufacturer or from veterinary consultation (based on mg/body weight of the treated animal or any available recommendations based on residue avoidance): ceftiofur routine dose (0.10 to 0.20 mg/egg or chick), gentamicin routine dose (0.20 mg/chick or egg), lincomycin-spectinomycin routine dose (0.75 mg/egg or chick consisting of 0.50 mg spectinomycin and 0.25 mg of lincomycin).

ANTIMICROBIAL USE IN FEED

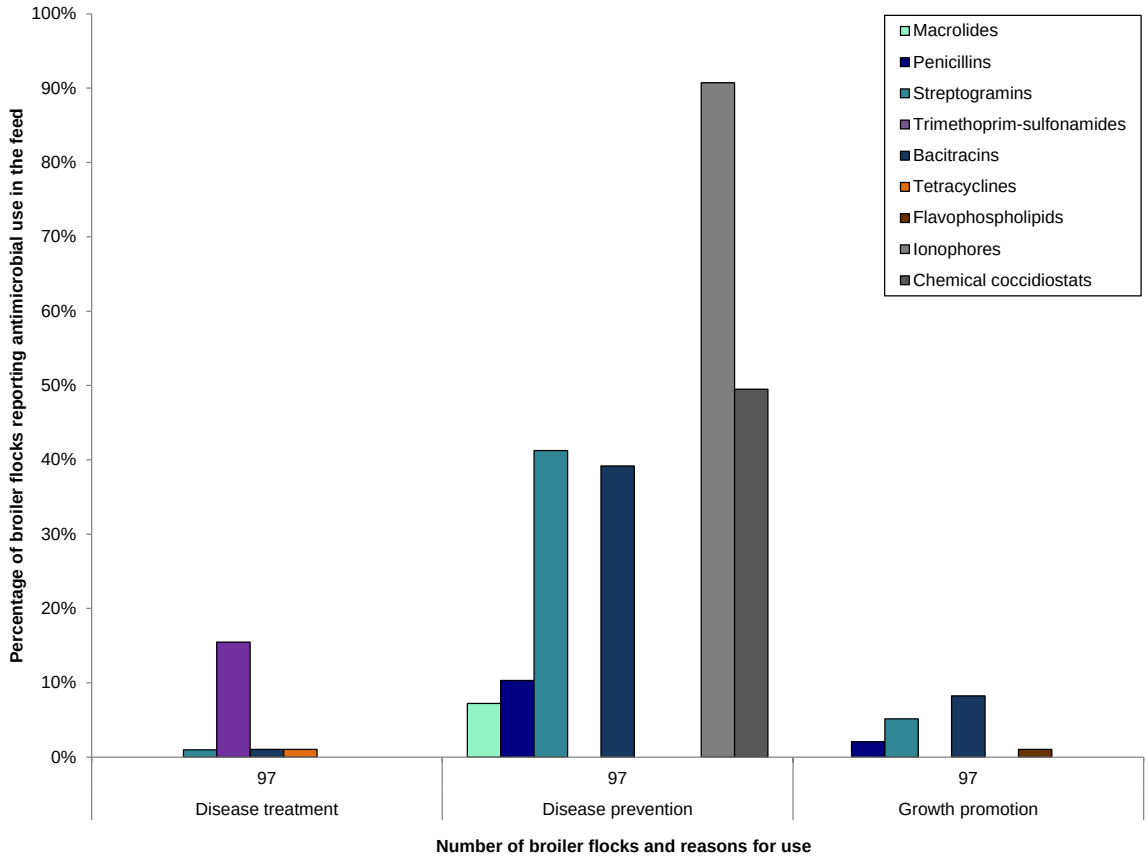
Figure 1.4. Percentage of broiler flocks reporting antimicrobial use in feed by province, 2013



Province		National	British Columbia	Alberta	Ontario	Québec
Number of flocks		97	24	15	30	28
Antimicrobial class						
II	Macrolides	7%	0%	7%	20%	0%
	Penicillins	12%	50%	0%	0%	0%
	Streptogramins	46%	54%	40%	43%	46%
	Trimethoprim-sulfonamides	15%	0%	0%	23%	29%
III	Bacitracins	48%	50%	67%	37%	50%
	Tetracyclines	1%	0%	0%	3%	0%
IV	Flavophospholipids	1%	0%	0%	0%	4%
	Ionophores	91%	88%	93%	87%	96%
N/A	Chemical coccidiostats	49%	63%	13%	53%	54%
	No antimicrobial use in feed	7%	13%	0%	10%	4%

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).
Ionophores and chemical coccidiostats are listed in Table 1.2 and Table 1.4.
Two cohort flocks with hatchery-level data/sampling were not sampled at pre-harvest and were excluded in the farm total.
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.

Figure 1.5. Percentage of broiler flocks reporting antimicrobial use in feed by primary reason, 2013

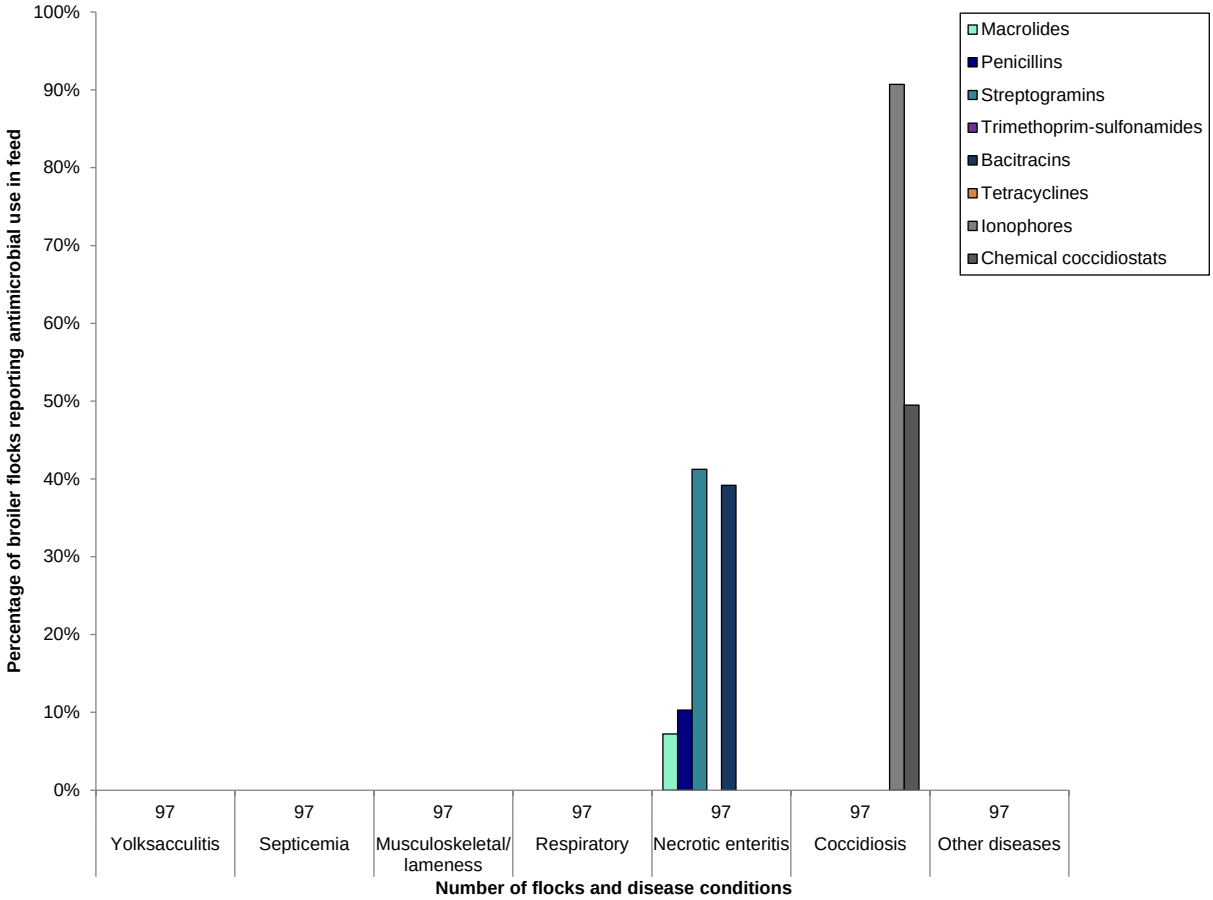


Primary reasons for use Number of flocks		Disease treatment 97	Disease prevention 97	Growth promotion 97
Antimicrobial class				
II	Macrolides	0%	7%	0%
	Penicillins	0%	10%	2%
	Streptogramins	1%	41%	5%
	Trimethoprim-sulfonamides	15%	0%	0%
III	Bacitracins	1%	39%	8%
	Tetracyclines	1%	0%	0%
IV	Flavophospholipids	0%	0%	1%
	Ionophores	0%	91%	0%
N/A	Chemical coccidiostats	0%	49%	0%

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).
Ionophores and chemical coccidiostats are listed in Table 1.2 and Table 1.4.
Growth promotion includes production uses/claims listed in the Compendium of Medicating Ingredients Brochure[9] other than disease prevention or treatment such as 1) to increase the rate of weight gain, and 2) to improve feed efficiency.

[9] Available at: www.inspection.gc.ca/animals/feeds/medicating-ingredients/eng/1300212600464/1320602461227. Accessed January 2016.

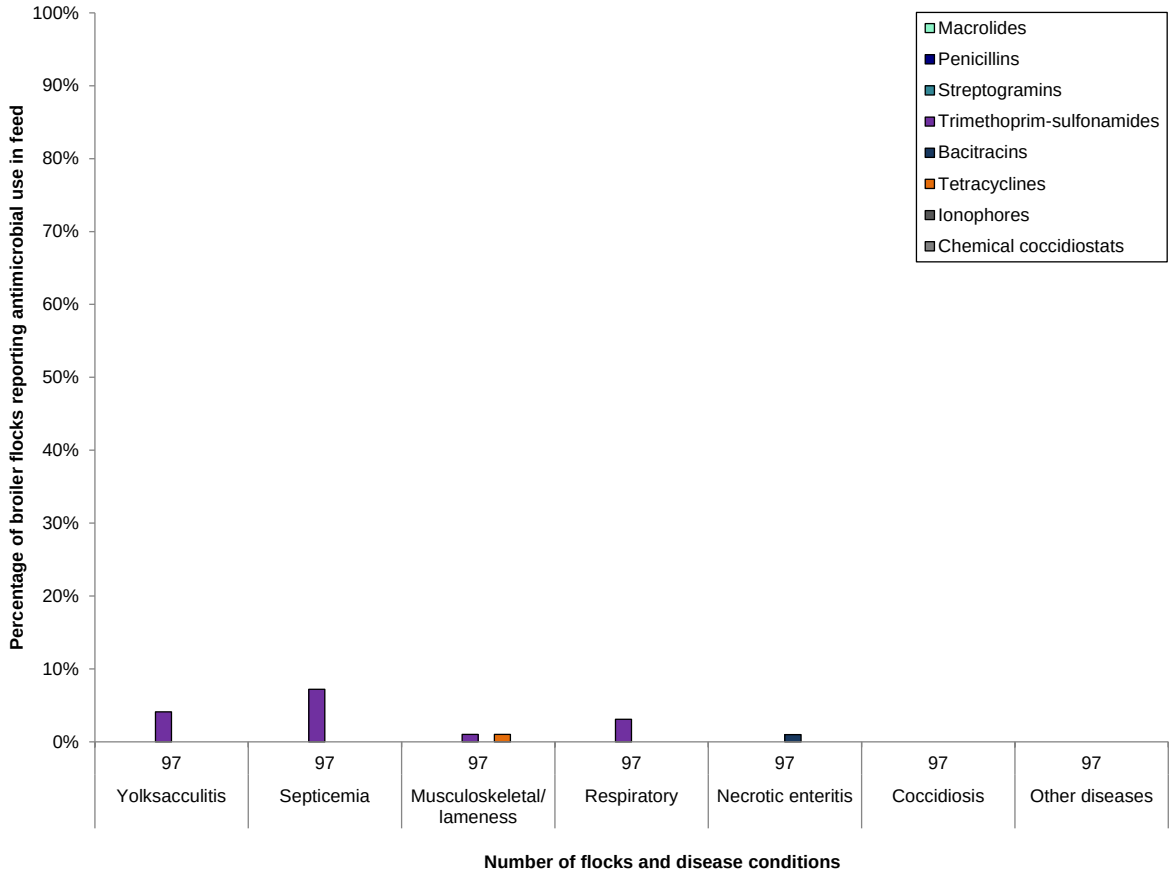
Figure 1.6. Percentage of broiler flocks reporting antimicrobial use in feed for *Disease prevention*, 2013



Primary reason for use		Disease prevention						
Disease conditions		Yolksacculitis	Septicemia	Musculoskeletal/ lameness	Respiratory	Necrotic enteritis	Coccidiosis	Other diseases
Number of flocks		97	97	97	97	97	97	97
Antimicrobial class								
II	Macrolides	0%	0%	0%	0%	7%	0%	0%
	Penicillins	0%	0%	0%	0%	10%	0%	0%
	Streptogramins	0%	0%	0%	0%	41%	0%	0%
	Trimethoprim-sulfonamides	0%	0%	0%	0%	0%	0%	0%
III	Bacitracins	0%	0%	0%	0%	39%	0%	0%
	Tetracyclines	0%	0%	0%	0%	0%	0%	0%
IV	Ionophores	0%	0%	0%	0%	0%	91%	0%
N/A	Chemical coccidiostats	0%	0%	0%	0%	0%	49%	0%

Roman numerals II to IV indicate categories of importance of human medicine as outlined by the Veterinary Drugs Directorate.
N/A=not applicable (no classification at the time of writing of this report).
Ionophores and chemical coccidiostats are listed in Table 1.2 and Table 1.4.

Figure 1.7. Percentage of flocks reporting antimicrobial use in feed for *Disease treatment*, 2013



Primary reason for use		Disease treatment						
Disease conditions		Yolksacculitis	Septicemia	Musculoskeletal/ lameness	Respiratory	Necrotic enteritis	Coccidiosis	Other diseases
Number of flocks		97	97	97	97	97	97	97
Antimicrobial class								
II	Macrolides	0%	0%	0%	0%	0%	0%	0%
	Penicillins	0%	0%	0%	0%	0%	0%	0%
	Streptogramins	0%	0%	0%	0%	0%	0%	0%
	Trimethoprim-sulfonamides	4%	7%	1%	3%	0%	0%	0%
III	Bacitracins	0%	0%	0%	0%	1%	0%	0%
	Tetracyclines	0%	0%	1%	0%	0%	0%	0%
IV	Ionophores	0%	0%	0%	0%	0%	0%	0%
N/A	Chemical coccidiostats	0%	0%	0%	0%	0%	0%	0%

Roman numerals II to IV indicate categories of importance of human medicine as outlined by the Veterinary Drugs Directorate.
N/A=not applicable (no classification at the time of writing of this report).
Ionophores and chemical coccidiostats are listed in Table 1.2 and Table 1.4.

Table 1.4. Quantitative summary of antimicrobial use in feed, 2013

	Antimicrobial	Flocks n (%)	Rations n (%)	Days exposed median (min. ; max.)[a]	Inclusion rate (g/tonne) median (min. ; max.)[b]	Grams/1,000 chicken-days median (min. ; max.)[c,d,e]
II	Tylosin	7 (7%)	23 (3)	9 (3 ; 16)	22 (22 ; 22)	3 (1 ; 5)
	Procaine benzylpenicillin	12 (12%)	22 (3)	8 (2 ; 14)	33 (33 ; 33)	3 (2 ; 5)
	Virginiamycin	46 (46%)	142 (17)	8 (1 ; 24)	22 (11 ; 22)	2 (0.4 ; 5)
	Trimethoprim-sulfadiazine	15 (15%)	16 (2)	4 (2 ; 9)	300 (200 ; 300)	37 (5 ; 48)
III	Bacitracin	47 (47%)	151 (19)	8 (1 ; 17)	55 (55 ; 110)	6 (1 ; 19)
	Oxytetracycline	1 (1%)	1 (0.1)	10 (10 ; 10)	440 (440 ; 440)	55 (55 ; 55)
IV	Bambermycin	1 (1%)	4 (0)	11 (8 ; 18)	2 (2 ; 2)	0.2 (0.1 ; 0.4)
	Lasalocid	10 (10%)	34 (4)	7 (4 ; 12)	60 (60 ; 60)	6 (1 ; 15)
	Monensin	28 (29%)	59 (7)	7 (1 ; 14)	99 (50 ; 132)	11 (1 ; 19)
	Narasin	21 (22%)	40 (5)	8 (2 ; 18)	70 (70 ; 70)	11 (8 ; 15)
	Narasin-nicarbazin	39 (31%)	67 (8)	10 (2 ; 16)	80 (80 ; 80)	5 (2 ; 12)
	Salinomycin	35 (36%)	96 (12)	8 (1 ; 24)	60 (50 ; 60)	8 (1 ; 13)
N/A	Clopidol	11 (11%)	20 (2)	10 (6 ; 17)	125 (125 ; 125)	6 (3 ; 10)
	Diclazuril	7 (7%)	7 (1)	7 (3 ; 9)	1 (1 ; 1)	0.2 (0.2 ; 0.2)
	Nicarbazin	34 (35%)	93 (11)	8 (1 ; 14)	50 (40 ; 125)	4 (1 ; 12)
	Zoalene	3 (3%)	6 (1)	10 (8 ; 12)	125 (125 ; 125)	7 (4 ; 10)
	Unmedicated flock/rations	7 (7)	30 (4)			

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).

[a] Days exposed are by ration.

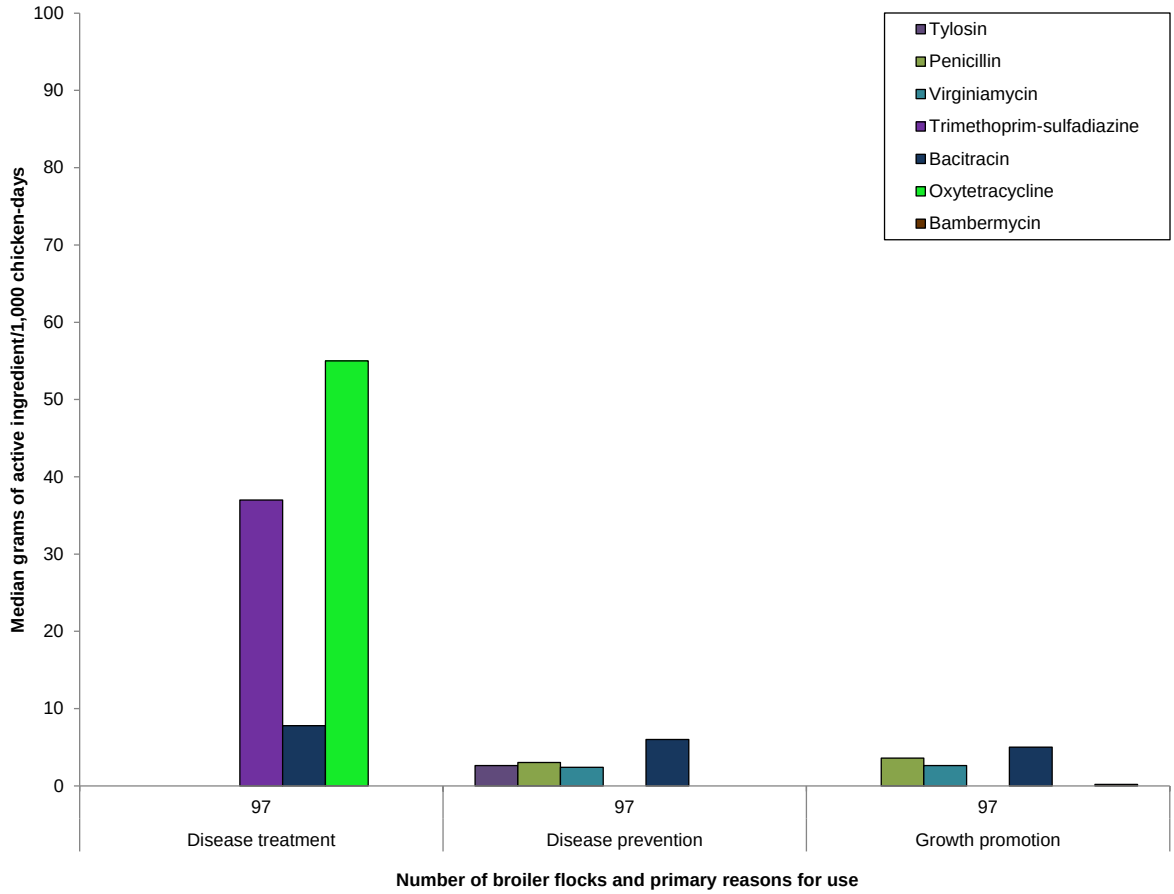
[b] Inclusion rate per tonne of feed reported by the veterinarian/producer.

[c] Estimates are based on consumption tables of the common breeds prevalent in Canada (Ross x Ross, Cobb x Cobb) and representative Canadian feed company standards (Nutreco, Wallenstein) for straight-run birds.

[d] Median use estimates are based on rations that used the specified antimicrobial and are estimated in "grams per 1,000 chicken-days".

[e] Grams per 1,000 chicken-days values are by ration.

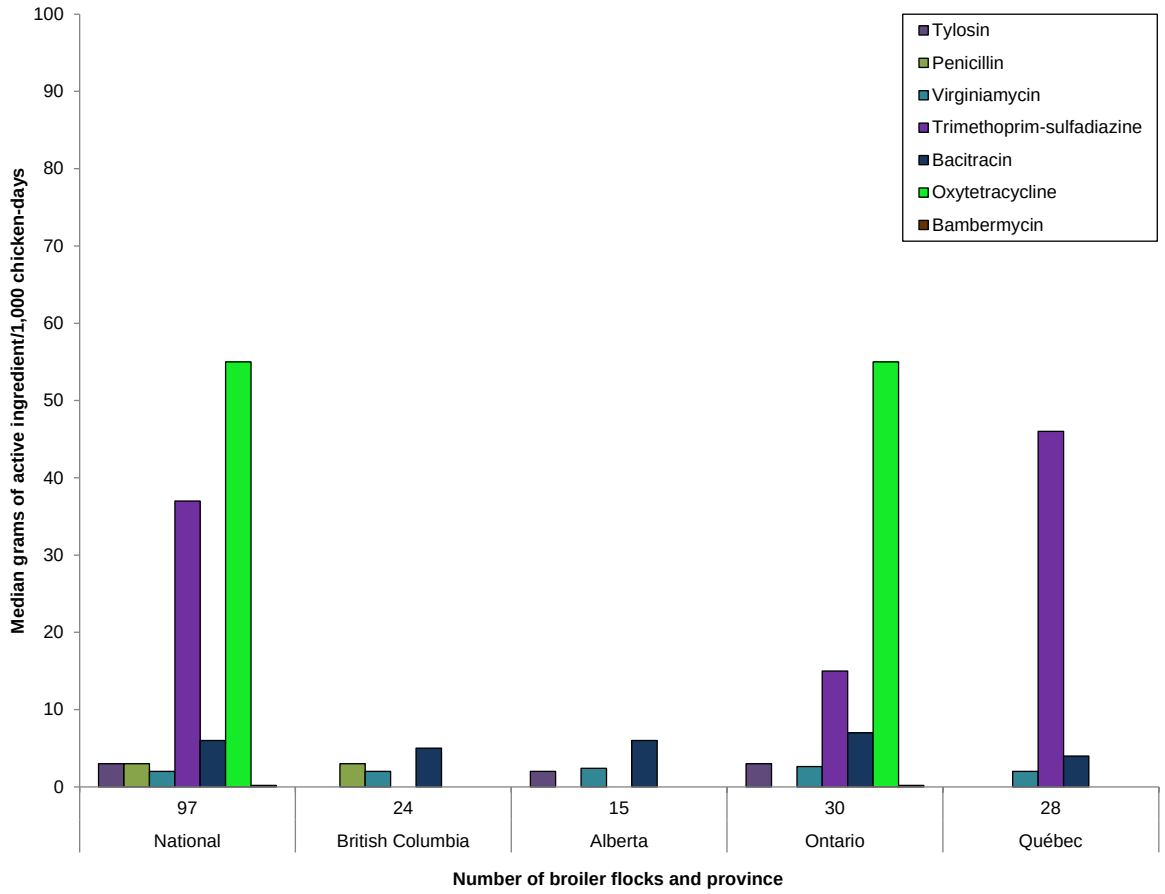
Figure 1.8. Quantity of antimicrobial use in feed by reason for use, 2013



Primary reasons for use Number of flocks		Disease treatment 97	Disease prevention 97	Growth promotion 97
Antimicrobial				
II	Tylosin	0 (0)	3 (25)	0 (0)
	Penicillin	0 (0)	3 (19)	4 (3)
	Virginiamycin	0 (0)	2 (120)	3 (22)
	Trimethoprim-sulfadiazine	37 (16)	0 (0)	0 (0)
III	Bacitracin	8 (3)	6 (124)	5 (24)
	Oxytetracycline	55 (1)	0 (0)	0 (0)
IV	Bambermycin	0 (0)	0 (0)	0.2 (4)

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Median use estimates are based on rations that used the specified antimicrobial and are estimated in "grams per 1,000 chicken-days".
Estimates are based on the average feed consumption from common breeds (Ross x Ross, Cobb x Cobb) and representative Canadian feed company standards for straight run birds.
Numbers in parentheses are total rations.

Figure 1.9. Quantity of antimicrobial use in feed by province, 2013

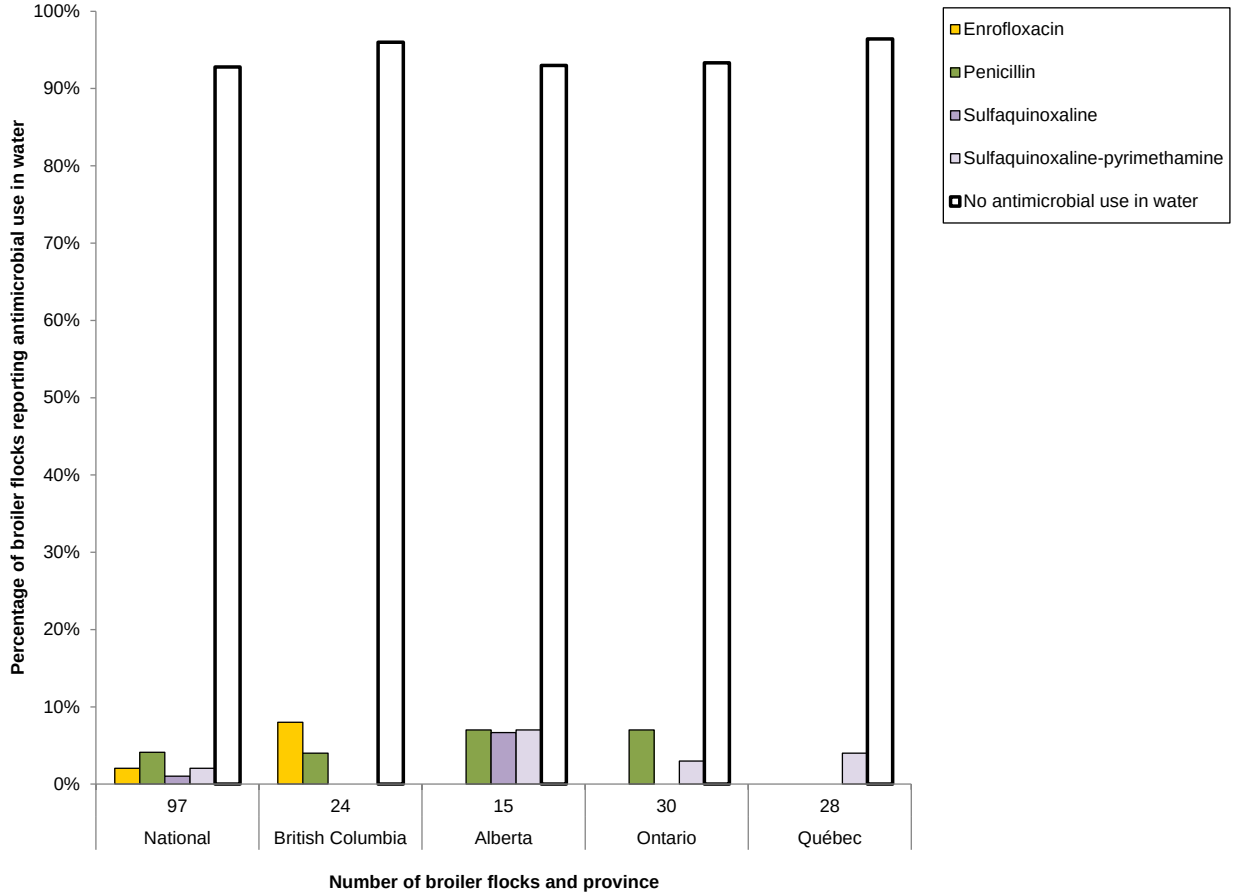


Province	National	British Columbia	Alberta	Ontario	Québec
Number of flocks	97	24	15	30	28
Antimicrobial					
II Tylosin	3 (25)	0 (0)	2 (2)	3 (23)	0 (0)
II Penicillin	3 (22)	3 (22)	0 (0)	0 (0)	0 (0)
II Virginiamycin	2 (142)	2 (35)	2 (21)	3 (48)	2 (38)
II Trimethoprim-sulfadiazine	37 (16)	0 (0)	0 (0)	15 (7)	46 (9)
III Bacitracin	6 (151)	5 (32)	6 (34)	7 (31)	4 (54)
III Oxytetracycline	55 (1)	0 (0)	0 (0)	55 (1)	0 (0)
IV Bambermycin	0.2 (4)	0 (0)	0 (0)	0.2 (4)	0 (0)

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Median use estimates are based on rations that used the specified antimicrobial and are estimated in "grams per 1,000 chicken-days".
Estimates are based on the average feed consumption from common breeds (Ross x Ross, Cobb x Cobb) and representative Canadian feed company standards for straight run birds.
This figure does not include ionophores and chemical coccidiostats.
Numbers in parentheses are total rations.

ANTIMICROBIAL USE IN WATER

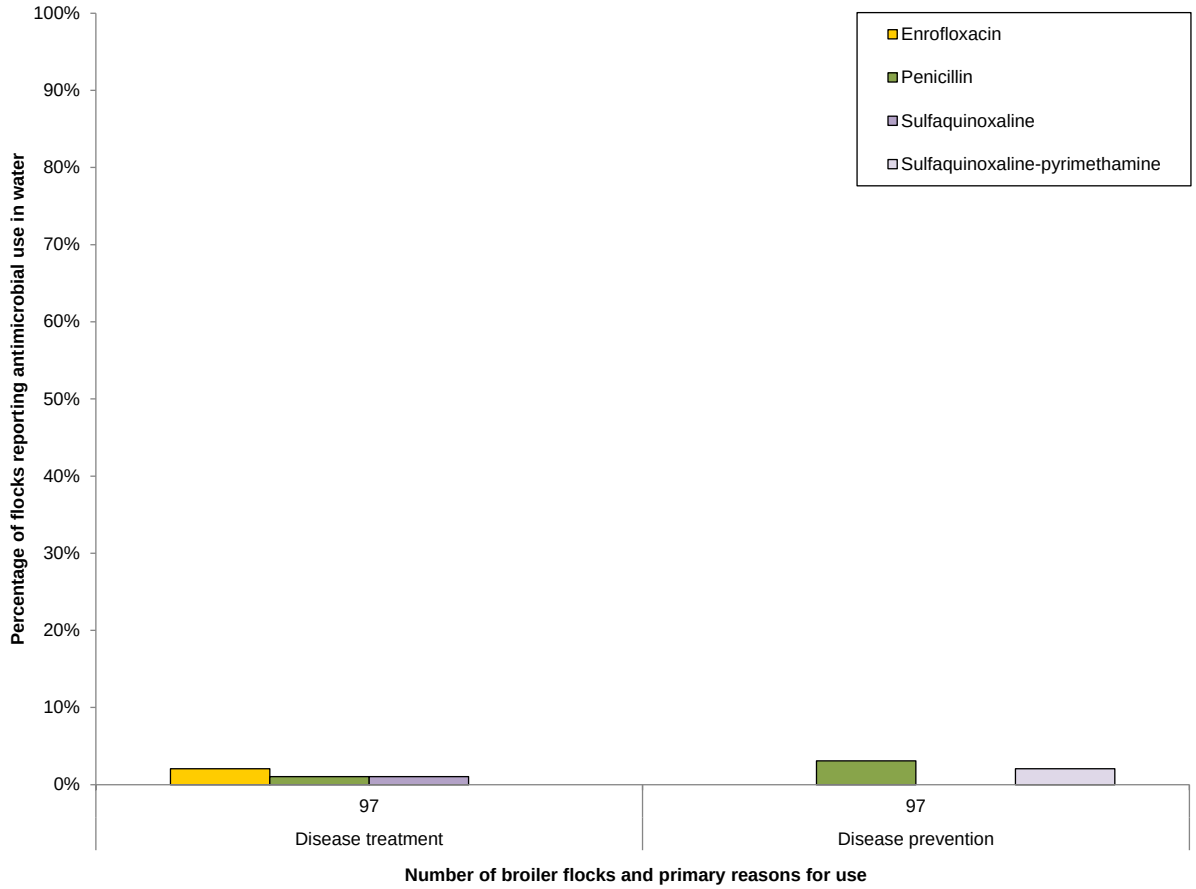
Figure 1.10. Percentage of broiler flocks reporting antimicrobial use in water by province, 2013



Province Number of flocks		National 97	British Columbia 24	Alberta 15	Ontario 30	Québec 28
Antimicrobial						
I	Enrofloxacin	2%	8%	0%	0%	0%
II	Penicillin	4%	4%	7%	7%	0%
III	Sulfaquinoxaline	1%	0%	7%	0%	0%
	Sulfaquinoxaline-pyrimethamine	2%	0%	7%	3%	4%
	No antimicrobial use in water	93%	96%	93%	93%	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.

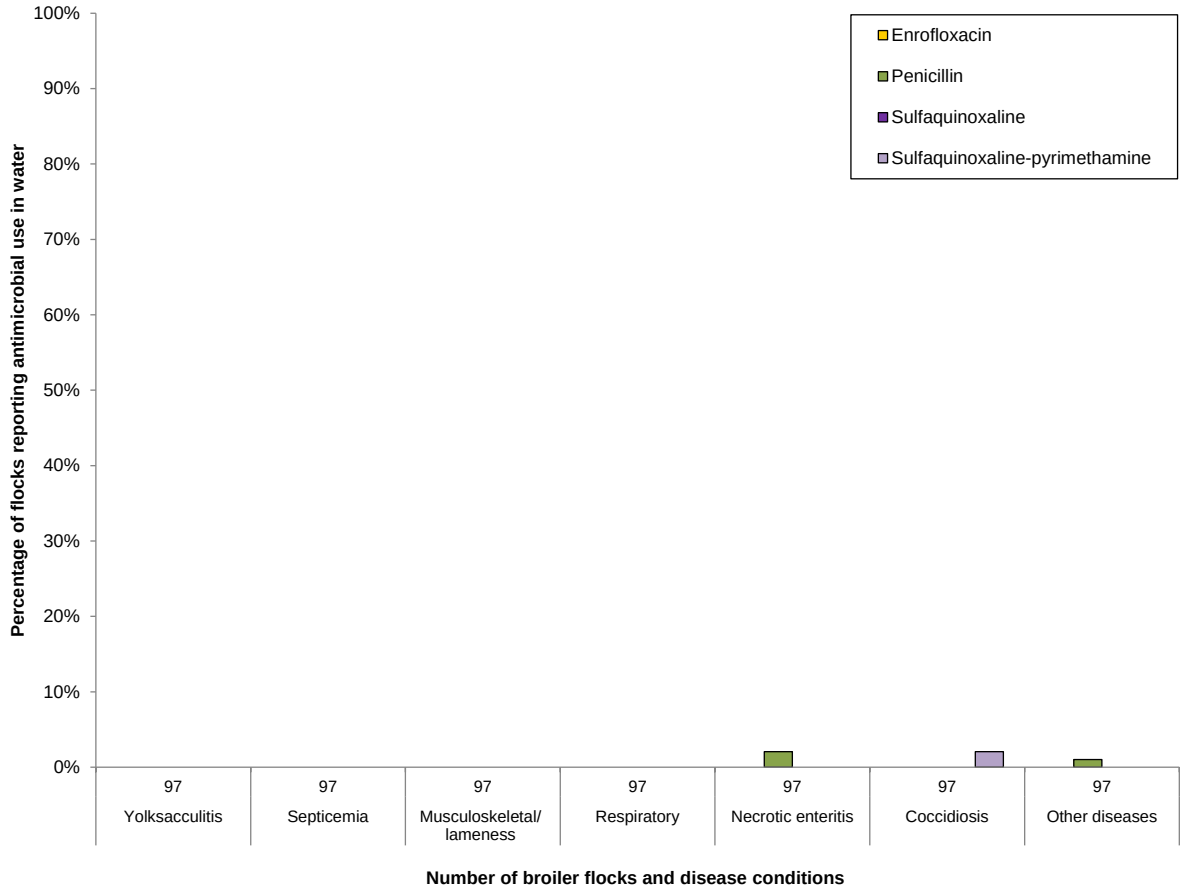
Figure 1.11. Percentage of broiler flocks reporting antimicrobial use in water by primary reason, 2013



Primary reasons for use Number of flocks		Disease treatment 97	Disease prevention 97
Antimicrobial			
I	Enrofloxacin	2%	0%
II	Penicillin	1%	3%
III	Sulfaquinoxaline	1%	0%
	Sulfaquinoxaline-pyrimethamine	0%	2%

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Respondents were instructed to select only one of "Disease treatment" or "Disease prevention" as a primary reason for use of an antimicrobial.

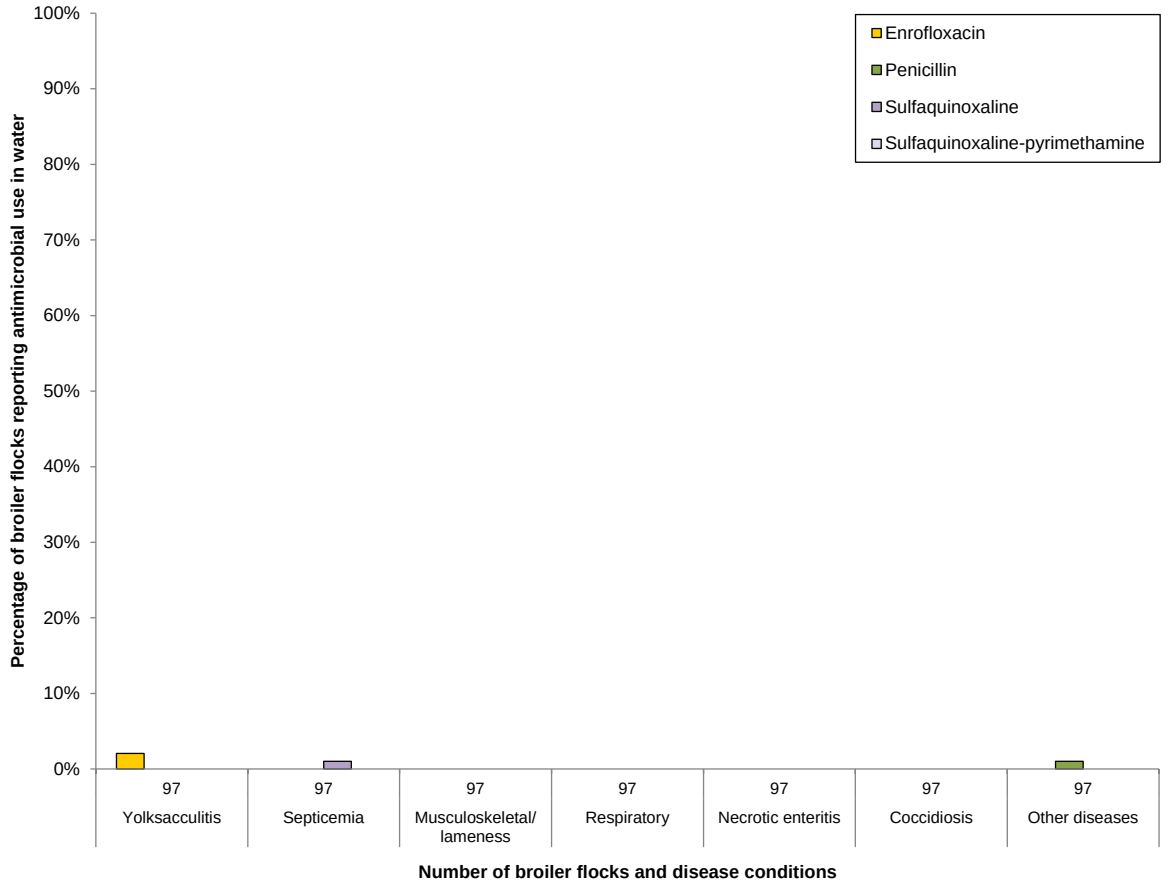
Figure 1.12. Percentage of broiler flocks reporting antimicrobial use in water for *Disease prevention*, 2013



Primary reason for use	Disease prevention						
Disease conditions	Yolksacculitis	Septicemia	Musculoskeletal/ lameness	Respiratory	Necrotic enteritis	Coccidiosis	Other diseases
Number of flocks	97	97	97	97	97	97	97
Antimicrobial							
I Enrofloxacin	0%	0%	0%	0%	0%	0%	0%
II Penicillin	0%	0%	0%	0%	2%	0%	1%
III Sulfaquinoxaline	0%	0%	0%	0%	0%	0%	0%
Sulfaquinoxaline-pyrimethamine	0%	0%	0%	0%	0%	2%	0%

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
For "Disease prevention", the respondents were instructed to select all applicable disease conditions.

Figure 1.13. Percentage of broiler flocks reporting antimicrobial use in water for *Disease treatment*, 2013



Primary reason for use	Disease treatment						
Disease conditions	Yolksacculitis	Septicemia	Musculoskeletal/ lameness	Respiratory	Necrotic enteritis	Coccidiosis	Other diseases
Number of flocks	97	97	97	97	97	97	97
Antimicrobial							
I Enrofloxacin	2%	0%	0%	0%	0%	0%	0%
II Penicillin	0%	0%	0%	0%	0%	0%	1%
III Sulfaquinoxaline	0%	1%	0%	0%	0%	0%	0%
Sulfaquinoxaline-pyrimethamine	0%	0%	0%	0%	0%	0%	0%

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
For "Disease treatment", the respondents were instructed to select all applicable disease.

Table 1.5. Quantitative summary of antimicrobial use in water, 2013

	Antimicrobial	Flocks n (%)	Days exposed median (min. ; max.)	Inclusion rate (g/L) median (min. ; max.)[a]	Grams/1,000 chicken-days median (min. ; max.)[b, c]
I	Enrofloxacin	2 (2%)	5 (5 ; 5)	0.02 (0.02 ; 0.02)	1 (1 ; 1)
II	Penicillin	4 (4%)	5 (3 ; 7)	0.2 (0.2 ; 0.3)	19 (12 ; 43)
III	Sulfaquinoxaline	1 (1%)	4 (4 ; 4)	2 (2 ; 2)	190 (190 ; 190)
	Sulfaquinoxaline-pyrimethamine	2 (2%)	2 (2 ; 2)	2 (2 ; 2)	248 (238 ; 258)

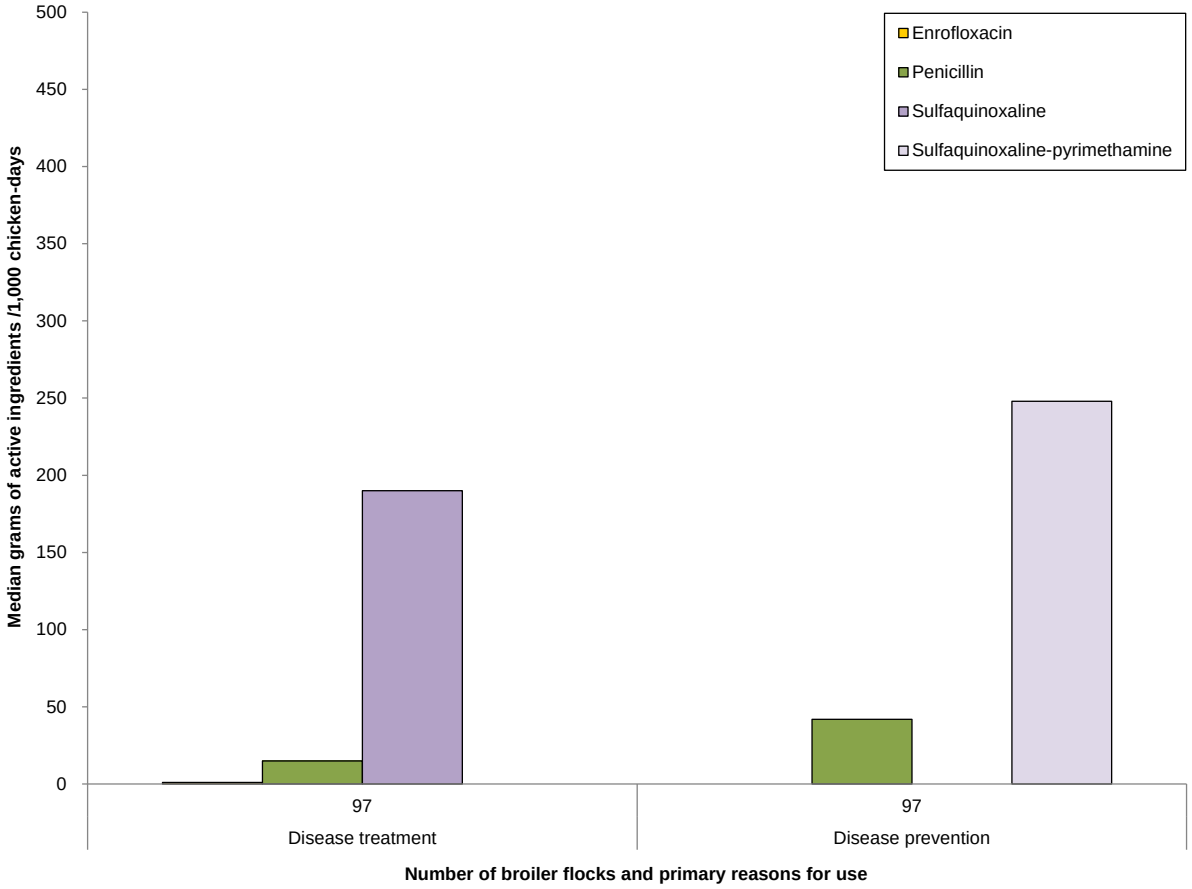
Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

[a] Inclusion rate in grams per liter of drinking water reported by the veterinarian/producer.

[b] Median use estimates are based on flocks that used the specified antimicrobial and are estimated in "grams per 1,000 chicken-days".

[c] Estimated based on daily water consumption chart (Nutreco Canada Inc.).

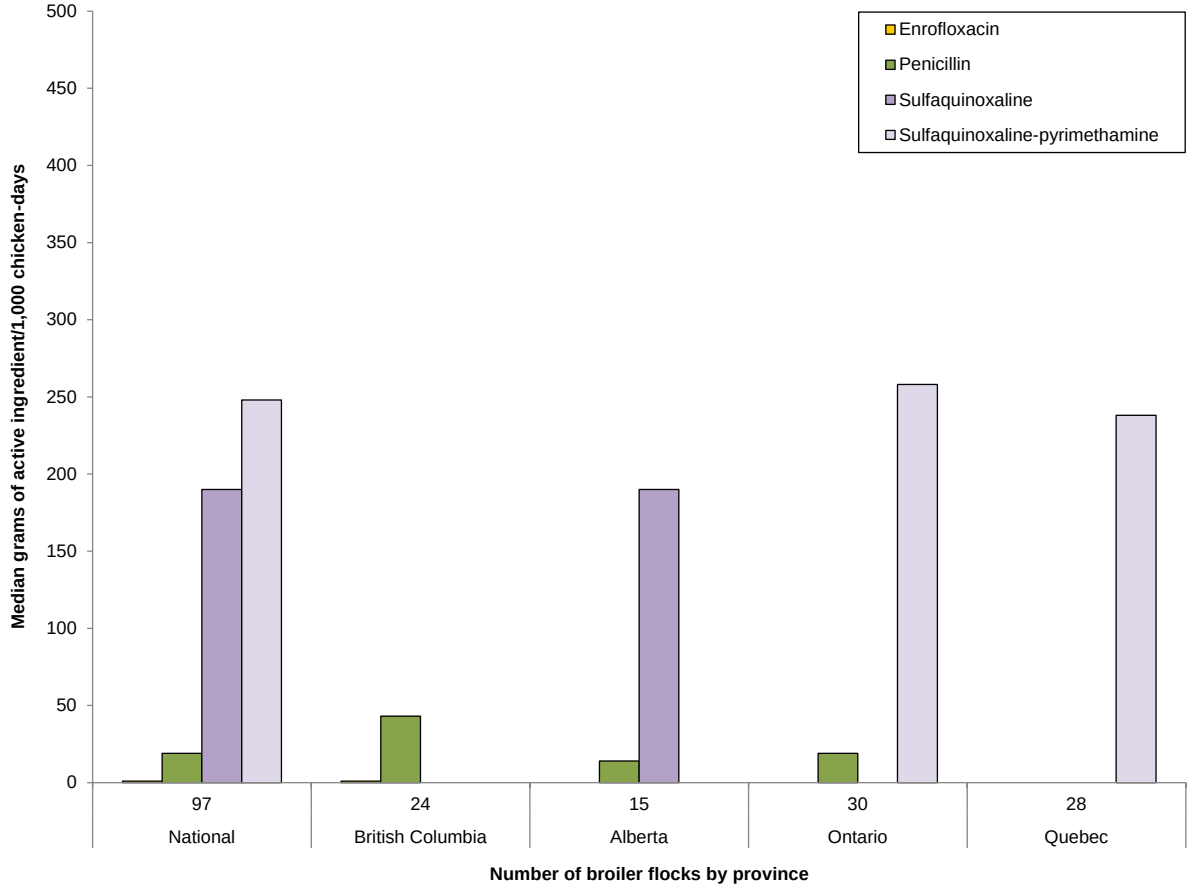
Figure 1.14. Quantity of antimicrobial use in water by reason for use, 2013



Primary reasons for use Number of flocks		Disease treatment 97	Disease prevention 97
Antimicrobial			
I	Enrofloxacin	1 (2)	0 (0)
II	Penicillin	15 (2)	42 (3)
III	Sulfaquinoxaline	190 (1)	0 (0)
	Sulfaquinoxaline-pyrimethamine	0 (0)	248 (2)

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Median use estimates are based on flocks that used the specified antimicrobial and are estimated in "grams per 1,000 chicken-days".
Numbers in parentheses are total number of water treatments; a flock may have been treated more than once during the grow-out period.
Estimated based on daily water consumption chart for broilers (Nutreco Canada Inc.).

Figure 1.15. Quantity of antimicrobial use in water by province, 2013



Province Number of flocks		National 97	British Columbia 24	Alberta 15	Ontario 30	Quebec 28
Antimicrobial						
I	Enrofloxacin	1 (2)	1 (2)	0 (0)	0 (0)	0 (0)
II	Penicillin	19 (5)	43 (1)	14 (1)	19 (3)	0 (0)
III	Sulfaquinoxaline	196 (1)	0 (0)	190 (1)	0 (0)	0 (0)
	Sulfaquinoxaline-pyrimethamine	248 (2)	0 (0)	0 (0)	258 (1)	238 (1)

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

Median use estimates are based on flocks that used the specified antimicrobial and are estimated in "grams per 1,000 chicken-days".

Estimates are based on daily water consumption chart (Nutreco Canada Inc.).

Numbers in parentheses are total number of water treatments; a flock may have been treated more than once during the grow-out period.

ANIMAL HEALTH AND BIOSECURITY

The animal health component of the questionnaire provided additional information about antimicrobial uses and reasons for use. Yolk sac infections (n=20 flocks) and septicemia (n=18), which are primarily caused by Avian pathogenic *E. coli,* and coccidiosis caused by various species of *Eimeria* affecting broilers, were the most commonly identified disease conditions that were confirmed positive or likely positive (Figure 1.15) by laboratory diagnosis and *post mortem* (Figure 1.16).

Vaccination of flocks at the hatchery was relatively common (93%, 92/99) and fewer flocks vaccinated/re-vaccinated during the grow-out period (41%, 40/97) (Table 1.8). These vaccines were aimed to prevent viral and bacterial infections prevalent in broilers in Canada (Figure 1.15).

Some aspects of biosecurity (National Avian On-farm Biosecurity Standards)[10] were determined at the time of visit and are summarized in Table 1.9. These data will provide understanding of the ecology of bacterial organisms isolated from the farm samples (e.g., pathogen retention and persistency of antimicrobial resistant organisms in the barns).

[10] Canadian Food Inspection Agency. National Avian On-Farm Biosecurity Standard. Available at: www.inspection.gc.ca/DAM/DAM-animals-animaux/STAGING/text-texte/terr_biosec_avian_standard_1375192173847_eng.pdf. Accessed January 2015.

Table 1.6. Summary of broiler farm characteristics, 2013

	Number of farms reporting	Units	Median	Mean	Min	Max	Total
Farm capacity[a]	97	Birds (n)	42,000	76,081	9,792	350,000	7,379,893
Chicks placed on floor sampled[b]	97	Chicks (n)	12,000	15,053	3,000	112,200	1,279,524
Chicks placed in barn sampled	97	Chicks (n)	20,706	24,168	3,600	112,200	2,344,264
Broiler population on floor at preharvest	97	Birds (n)	11,500	14,495	2,865	108,000	1,232,033
Broiler population in barn at preharvest	97	Birds (n)	20,000	23,227	3,312	108,000	2,253,014
Floor-level mortality at preharvest	97	Birds (%)	3	4	1	12	N/A
Barn-level mortality at preharvest	97	Birds (%)	3	4	1	12	N/A
Domestic chicks placed, proportion delivered	96	Birds (%)	100	97	11	100	N/A
Youngest age of breeder source in chicks delive	96	Age (weeks)	34	37	26	58	N/A
Oldest age of breeder source in chicks delivered	96	Age (weeks)	50	46	27	62	N/A
Imported chicks placed, proportion delivered	8	Birds (%)	70	66	5	100	N/A
Youngest age of breeder source in chicks delive	8	Age (weeks)	34	35	29	42	N/A
Oldest age of breeder source in chicks delivered	8	Age (weeks)	40	41	30	55	N/A
Hatchery sources	99	Establishment (n)	N/A	N/A	N/A	N/A	16
Age of broilers at preharvest sampling day	97	Days (n)	34	34	25	49	N/A
Weight of broilers at preharvest sampling day	97	kg	1.95	2.02	1.15	3.70	N/A
Stocking density	97	Chicks placed/sq ft	0.84	0.91	0.46	2.40	N/A
Quota Period[c]	97	n	N/A	N/A	N/A	N/A	5
Downtime[d]	97	Days (n)	16	21	10	365	N/A

N/A=not applicable.

[a] Total capacity of the 99 farms participated in the 2013 sampling year. Estimated number of birds grown in the 99 participating farms in 2013 sampling year in approximately 6 quota periods (A-115 to A-121) is equivalent to 8% of national production (7,379,893 x 7 grow-out periods/627,185,689 heads, source: AAFC 2014 chicken slaughter volume, number of heads).

[b] Two cohort flocks not sampled at pre-harvest were excluded.

[c] Quota period is an 8-week production period (A-116 to A-121) in the Chicken Farmers of Canada Allocation Calendar.

[d] In the poultry industry, this pertains to a period of time between flocks, starting with a barn being emptied of birds and ending with the placement of chicks. It allows for the natural reduction in number of diseases causing micro-organisms within the barn (i.e., carry-over from previous flock)[11].

[11] Chicken Farmers of Canada, On-farm Food Safety Program. Available at: www.chickenfarmers.ca/wp-content/uploads/2014/07/OFFSAP-Manual-2014.pdf. Accessed January 2016.

Table 1.7. Summary of broiler production and operational factors, 2013

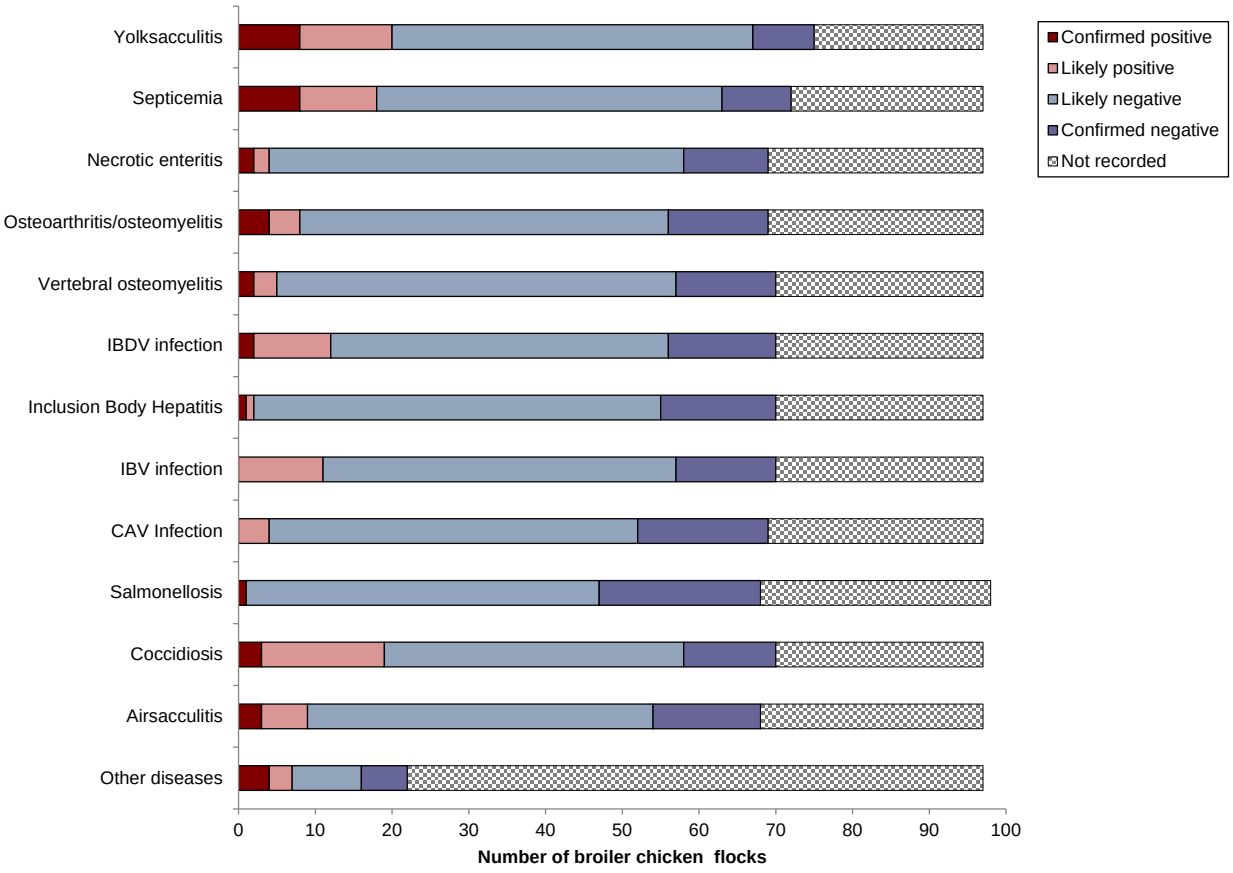
Operational factors	Units	Total
Operational factors		
All-in-all-out	Farms (n)	82
Multi-barn facilities	Farms (n)	16
Multispecies/commodity	Farms (n)	1
Production type		
Antimicrobial-free[a]	Flocks (n)	5
Conventional	Flocks (n)	93
Organic[b]	Flocks (n)	1
Strains		
Ross x Ross		
Ross 308	Flocks (n)	63
Ross 708	Flocks (n)	17
Unspecified or unknown	Flocks (n)	9
Cobb x Cobb		
Cobb 500	Flocks (n)	4
Cobb 700	Flocks (n)	1
Unspecified or unknown	Flocks (n)	8

[a] Antimicrobial free production in Canada is synonymous to "Raised Without Antibiotics"; an animal production claim. The Canadian Food Inspection Agency states: "this will be acceptable provided the animals were not administered any medication that could fall in the definition of an antibiotic or have the same purpose, for example, coccidiostats or monensin"[12]. Flocks in this category were not medicated with any antimicrobials including ionophores or chemical coccidiostats in any route of administration from incubation to pre-harvest stage.

[b] Also an animal production claim that requires mandatory certification to the revised National Organic Standard[15].

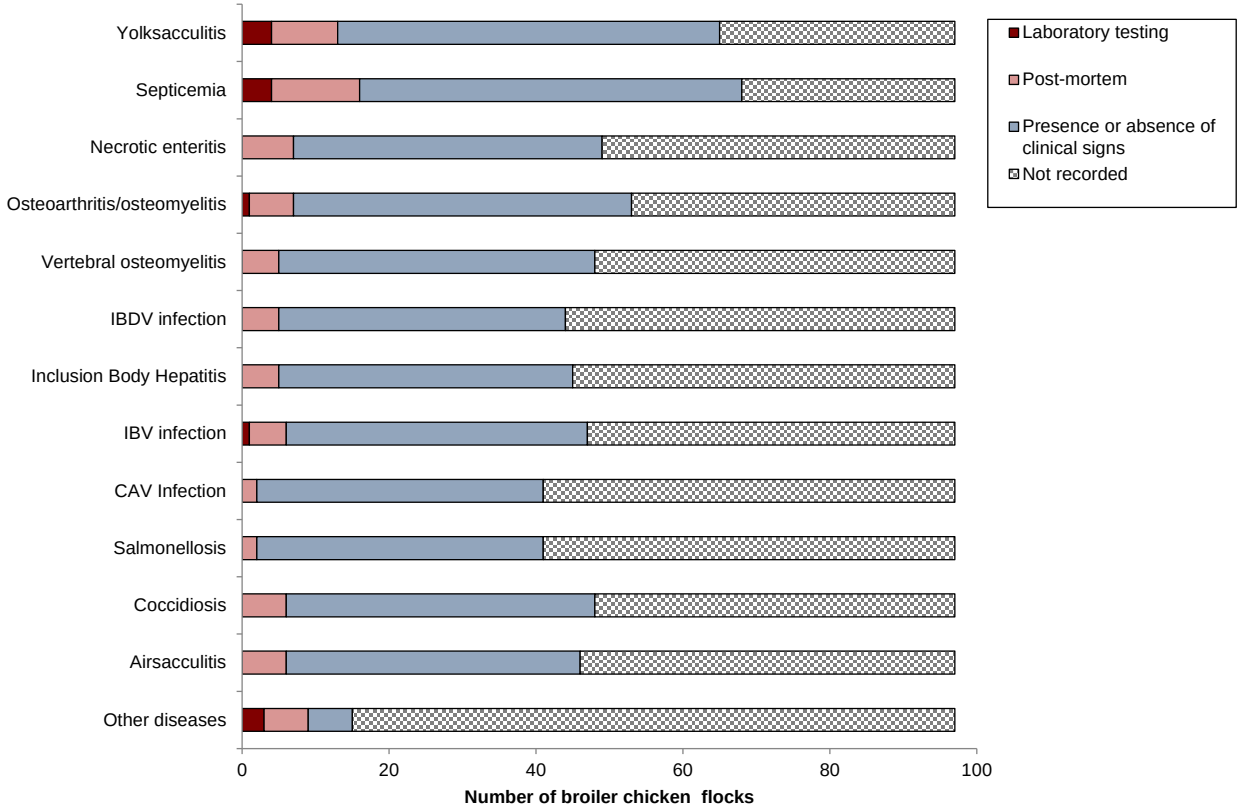
[12] Canadian Food Inspection Agency. Available at: http://www.inspection.gc.ca/food/meat-and-poultry-products/manual-of-procedures/chapter-7/eng/1367720000285/1367720106452?chap=7. Accessed 28 January 2016.

Figure 1.16. Health status of broiler chicken flocks during the grow-out period, 2013



CAV=Chicken Anemia Virus.
IBDV=Infectious Bursal Disease Virus.
IBV=Infectious Bronchitis Virus.
Common disease agents implicated in disease syndromes above are: avian pathogenic *E. coli* (for yolksacculitis and septicemia), *Clostridium perfringens* (necrotic enteritis), *Staphylococcus aureus* and/or *Streptococcus* spp. (for osteomyelitis/osteoarthritis), and *Enterococcus cecorum* (for vertebral osteomyelitis).
Other diseases include ascites (metabolic), complicated chronic *E. coli* infections (airsacculitis and synovitis), reovirus-like signs (tenosynovitis) and tibial dyschondroplasia.
The respondents were instructed to select all applicable diseases and only one of "Confirmed positive", "Likely positive", "Likely negative" and "Confirmed negative".

Figure 1.17. Disease diagnostic tools to establish the animal health status of the flock, 2013



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Other diseases include ascites (metabolic), complicated chronic *E. coli* infections (airsacculitis and synovitis), reovirus-like signs (tenosynovitis) and tibial dyschondroplasia.
The respondents were instructed to select all applicable tools to establish the health status of the broiler flocks.
The total flocks reporting diagnostic tools (depicted in red, blue, and grey bars) are total number of responses and do not necessary indicate a disease-positive status.
Grey bars represent flocks that have no recorded disease diagnostic tool applied.

Table 1.8. Vaccination summary of broiler chicken flocks at the hatchery and after chick placement, 2013

Agent/disease	Vaccine strains	Number of flocks n (%)	Vaccination age Days, median (min. ; max.)
Hatchery-level applications[a]			
Coccidiosis	*Eimeria* spp. (broiler strains)	11 (11)	N/A
Infectious Bronchitis Virus	Massachusetts	81 (82)	N/A
	Massachusetts-Connecticut	1 (1)	N/A
Infectious Bursal Disease Virus (IBD)	Standard/classical	6 (6)	N/A
Marek's Disease Virus	HVT	58 (59)	N/A
Marek's Disease Virus-IBD	Vectored HVT, VP2 antigen	26 (26)	N/A
Escherichia coli	O78 strain	1 (1)	N/A
Farm applications[b]			
Infectious Bronchitis Virus	Massachusetts	10 (10)	13 (7, 21)
	Massachusetts-Connecticut	8 (8)	12 (7, 14)
Infectious Bursal Disease Virus	Standard/classical	31 (32)	10 (1, 14)
Escherichia coli	O78 strain	1 (1)	7 (7, 7)
Reovirus	Tynosynovitis biotype	1 (1)	10 (10, 10)

The respondents were instructed to select all applicable vaccines administered at the hatchery. If flocks were also vaccinated on-farm after placement, the respondents were instructed to indicate the age of the flock for each vaccine application.

N/A=all hatchery level administrations were either at day 18 of incubation or at the day of hatch (Day 1).

[a] Flocks (93%, 92/99) were vaccinated with 1 or more agent at the hatchery.

[b] Flocks (41%, 40/97) were vaccinated with 1 or more agent after placement on-farm.

Table 1.9. Biosecurity summary, 2013

	Response			All applicable subcategories	Proportion of farms[a]
	Unknown	No	Yes		
Access management					
Presence of livestock and poultry within a 1 km radius	0%	16%	84%	Broilers	46%
				Broiler breeders	1%
				Hatchery	1%
				Layers	19%
				Turkeys	16%
				Cattle	38%
				Pigs	21%
				Other animals	3%
Presence of domestic and wild animals on-farm as observed at the time of visit	0%	59%	41%	Dogs	23%
				Cats	12%
				Horses	10%
				Other domestic/wild	4%
Recognizable biosecurity zone	0%	2%	98%		
Foot bath/foot dip	0%	72%	28%		
Personal protective equipment required for access to production areas	0%	6%	94%	Boots	94%
				Gloves	43%
				Coveralls or designated farm clothes	71%
Animal health management					
Downtime between flocks[b]	0%	1%	99%		
Operational management					
Daily dead bird collection/removal from production areas	0%	4%	96%		
Manure stored within farm premise	0%	47%	53%	Adjacent to barns	11%
				Designated storage within controlled access zone	34%
				Others (100 to 400 meters away from barn, field behind barn and other farm sites/same owner)	9%

[a] The respondents were instructed to select all applicable specific type if the response was "Yes". Total % may not be 100% because of multiple options provided per item.

[b] See demographics Table 1.6 for observed downtime days.

Table 1.9. Biosecurity summary, 2013 (cont'd)

	Response			All applicable subcategories	Proportion of farms[a]
	Unknown	No	Yes		
Operational management, continued					
Manure removal process				Removed from barn under nutrient management plan	38%
				On-farm composting	5%
				Spread on field (0.5 km from farm)	27%
				Spread on field (> 1 km away from farm)	29%
				Spread elsewhere by contracted services	44%
				elsewhere, mushroom farm use)	6%
Months of spread if spread on field	N/A	N/A	N/A	January	2%
				February	1%
				March	4%
				April	13%
				May	19%
				June	4%
				July	5%
				August	7%
				September	18%
				October	23%
				November	10%
				December	1%
Integrated pest control program	0%	2%	98%	Rodents	96%
				Beetles	93%
				Wild birds	51%
				Flies	48%
				Others (wildlife control)	6%

N/A=Not applicable.

[a] The respondents were instructed to select all applicable specific type if the response was "Yes". Total % may not be 100% because of multiple options provided per item.

Table 1.9. Biosecurity summary, 2013 (cont'd)

	Response			All applicable subcategories	Proportion of farms[a]
	Unknown	No	Yes		
Operational management, continued					
Premise cleaning and washing for the cycle	0%	8%	92%	Dry clean only	37%
				Dry clean and washed	18%
				Washed	23%
				Washed, hot water	25%
Premise disinfection	1%	23%	76%	Quaternary ammonium compounds	39%
				Aldehydes	22%
				Phenol	6%
				Chlorine-based	13%
				Others (combination, various ingredients)	6%
Water source				Municipal	29%
				Well water	64%
				Ponds, other surface waters	4%
				Others (dug-out, rain water collected in cisterns)	4%
Water analysis done regularly	0%	1%	99%	Monthly	2%
				Yearly	92%
				Other (quarterly, 2-3 times a year)	6%
Water treatment between flocks	1%	14%	85%	Chlorine-based	34%
				Hydrogen peroxide	37%
				Water acidifiers	16%
				Iodine	3%
				Others (reverse osmosis, ultraviolet, disinfectants)	11%
Water treatment during the growing period	0%	19%	81%	Chlorine-based	59%
				Hydrogen peroxide	19%
				Water acidifiers	27%
				Iodine	1%
				Others (surface water treatment/mud reduction, phosphoric acids, reverse osmosis system, ultraviolet)	7%

[a] The respondents were instructed to select all applicable specific type if the response was "Yes". Total % may not be 100% because of multiple options provided per item.

2. FARM SURVEILLANCE—GROWER-FINISHER PIGS

KEY FINDINGS

- The frequency of antimicrobial exposure through feed was the greatest among all of routes of administration in grower-finisher pigs over 2009 to 2013; 77% (348/454) of grow-finish periods reported using antimicrobials in feed compared to 61% (275/454) by injection and 26% (116/454) in water.
- Among participating swine herds, the most commonly used antimicrobials by all routes of administration included penicillin G (61%, 54/89), lincomycin (40%, 36/89), tylosin (33%, 29/89) and chlortetracycline (30%, 27/89) (Table 2.2).
- Of the Category I antimicrobials, the use of ceftiofur injection was reported by 18% (16/89) of the herds (Table 2.2); 1 herd reported the use of enrofloxacin under "Other" injectable antimicrobials.
- Twelve (13%, 12/89 herds) reported that they did not use any antimicrobials in grower-finisher pigs, by any route of administration (Table 2.1).

ADMINISTRATION IN FEED

- The median number of different rations fed per grow-finish period was 4 with a minimum number of 1 to a maximum of 17 rations. A median of 4 rations per period was consistent across all 5 years (2009 to 2013).
- A median of 66% of rations were reported to be medicated with antimicrobials in 2013, which indicates a decreasing trend compared to the proportions reported in 2011 (80%) and 2012 (75%).
- In 2013, 27% (24/89) of herds reported “no antimicrobial use” in feed (Figure 2.1); this is a significant increase over that reported in 2012 (18%, 16/87) and a return to proportions noted in 2009 (24%, 23/95) and 2010 (26%, 23/90).
- Among antimicrobial uses in feed reported over 2009 to 2013, disease treatment was not a common reason for use (8%, 37/454) compared to disease prevention (51%, 231/454) or growth promotion (41%, 184/454).
- For disease prevention, the most commonly used antimicrobial classes in feed in 2013 were tetracyclines (24%, 21/89), macrolides (18%, 16/89), and lincosamides (20%, 18/89). This ranking was consistent through 2009 to 2012 (Figure 2.2).

- Tetracyclines were most commonly used in the prevention of respiratory disease (20%, 18/89), and for the prevention of enteric disease macrolides (14%, 12/89) and lincosamides (11%, 10/89) were most commonly used. This ranking was consistent through 2009 to 2013. Less than 5% of herds used antimicrobials in feed for the prevention of lameness in all 5 years, 2009 to 2013 (Figure 2.4).
- The antimicrobial classes most commonly used for growth promotion in feed were macrolides (16%, 14/89) and ionophores (18%, 16/89) (Figure 2.2).
- The greatest median days of exposure to antimicrobials through feed in 2013 were for tylosin (63 days), bacitracin (56 days), and lincomycin (40 days) (Table 2.3).
- The greatest median grams per 1,000 pig-days (g/TPD)in feed in 2013 were chlortetracycline (758 g/TPD), tilmicosin (451 g/TPD), lincomycin (98 g/TPD), sulfamethazine (166 g/TPD), and salinomycin (61 g/TPD) (Table 2.3).
- There was a notable overlap in the quantity of antimicrobials used (median g/TPDAR) between disease treatment, disease prevention, and growth promotion uses of antimicrobials in feed; in general, quantities tended to be lower for disease prevention and growth promotion relative to disease treatment (Figure 2.5).
- The duration of use in feed varied by antimicrobial but tylosin, salinomycin, and lincomycin were used in feed throughout the grow-finish period in all 5 years, 2009 to 2013 (Figure 2.6).
- Virginiamycin was used in feed by fewer herds in 2013 (3%) relative to 2012 (7%); it was also fed throughout the grow-finish period (Figure 2.6).

ADMINISTRATION IN WATER

- Over the 5 year period 2009 to 2013, the proportion of herds reporting no antimicrobial use in water has ranged from 72% (2010) to 82% (2011); in 2013, 73% of herds (65/89) indicated they did not administer antimicrobials in water (Figure 2.7).
- In 2013, the antimicrobials most frequently reported for administration through water were penicillin (10%, 9/89) and trimethoprim-sulfadoxine (8%, 7/89) (Figure 2.7).
- Over all water administrations, 76% were for disease treatment (29/38) with the remainder attributed to disease prevention (24%, 9/38); medicated water was reported primarily for the prevention and treatment of respiratory disease (Figure 2.9 and Figure 2.10).
- Eighty-two percent (32/39) of the antimicrobial uses in water in 2013 were administered to 100% of the pigs (Table 2.5)

ADMINISTRATION BY INJECTION

- There were significantly fewer herds reporting that they did not use antimicrobials by injection in grower-finisher pigs in 2013 (34%, 30/89) when compared to 2009 (47%, 46/95) (Figure 2.11).
- The most common antimicrobials given by injection in 2013 were penicillin (53%, 47/89) and ceftiofur (18%, 16/89); this ranking was consistent through 2010-2012 (Figure 2.11).
- The most common reasons for use of antimicrobials by injection in 2013 were penicillin for the treatment of lameness (44%, 39/89) and for respiratory disease (18%, 16/89), and ceftiofur for respiratory disease (8%, 7/89), and ceftiofur for lameness (10%, 9/89). This ranking was consistent through 2009 to 2013 (Figure 2.12).
- When antimicrobials were used by injection in grower-finisher pigs, 95% of the time (104/110 uses in 2013), they were administered to less than 5% of the pigs (Table 2.7).

SUMMARY OF ANTIMICROBIAL USE BY ROUTE OF ADMINISTRATION

Table 2.1. Number of pig herds with reported use by route of administration, 2013

Antimicrobial use	Route of administration			
	Any Route[a] n (%)	Feed n (%)	Water n (%)	Injection n (%)
Any antimicrobial use	77 (87)	65 (73)	24 (27)	59 (66)
No antimicrobial use	12 (13)	24 (27)	65 (73)	30 (34)
Total Herds	**89 (100)**	**89 (100)**	**89 (100)**	**89 (100)**

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

Table 2.2. Number of pig herds (n = 89) reporting antimicrobial use, by route of administration, 2013

Antimicrobial classe		Antimicrobial	Route of administration			
			Any Route[a] n (%)	Feed n (%)	Water n (%)	Injection n (%)
I	Extended-spectrum cephalosporins	Ceftiofur	16 (18)	0 (0)	0 (0)	16 (18)
II	Aminoglycosides	Streptomycin	4 (4)	0 (0)	4 (4)	0 (0)
	Lincosamides	Lincomycin	36 (40)	30 (34)	1 (1)	10 (11)
	Macrolides	Erythromycin	0 (0)	0 (0)	0 (0)	0 (0)
		Tulathromycin	9 (10)	0 (0)	0 (0)	9 (10)
		Tilmicosin	3 (3)	3 (3)	0 (0)	0 (0)
		Tylosin	29 (33)	28 (31)	0 (0)	3 (3)
	Penicillins	Ampicillin	4 (4)	0 (0)	0 (0)	4 (4)
		Penicillin G	54 (61)	7 (8)	9 (10)	47 (53)
	Streptogramins	Virginiamycin	3 (3)	3 (3)	0 (0)	0 (0)
	Potentiated sulfonamides	Trimethoprim-sulfadoxine	10 (11)	0 (0)	7 (8)	4 (4)
III	Aminocyclotols	Spectinomycin	2 (2)	0 (0)	1 (1)	1 (1)
	Aminoglycosides	Neomycin	5 (6)	0 (0)	5 (6)	0 (0)
	Bacitracins	Bacitracin	1 (1)	1 (1)	0 (0)	0 (0)
	Phenicols	Florfenicol	6 (7)	0 (0)	0 (0)	6 (7)
	Pleuromutilins[b]	Tiamulin	7 (8)	7 (8)	0 (0)	0 (0)
	Sulfonamides	Sulfonamide (unspecified)	4 (4)	3 (3)	1 (1)	0 (0)
	Tetracyclines	Chlortetracycline	27 (30)	27 (30)	0 (0)	0 (0)
		Oxytetracycline	8 (9)	0 (0)	0 (0)	8 (9)
		Tetracycline hydrochloride	2 (2)	0 (0)	2 (2)	0 (0)
IV	Flavophospholipids	Bambermycin	1 (1)	1 (1)	0 (0)	0 (0)
	Ionophores	Salinomycin	18 (20)	18 (20)	0 (0)	0 (0)

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

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

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

ANTIMICROBIAL USE IN FEED

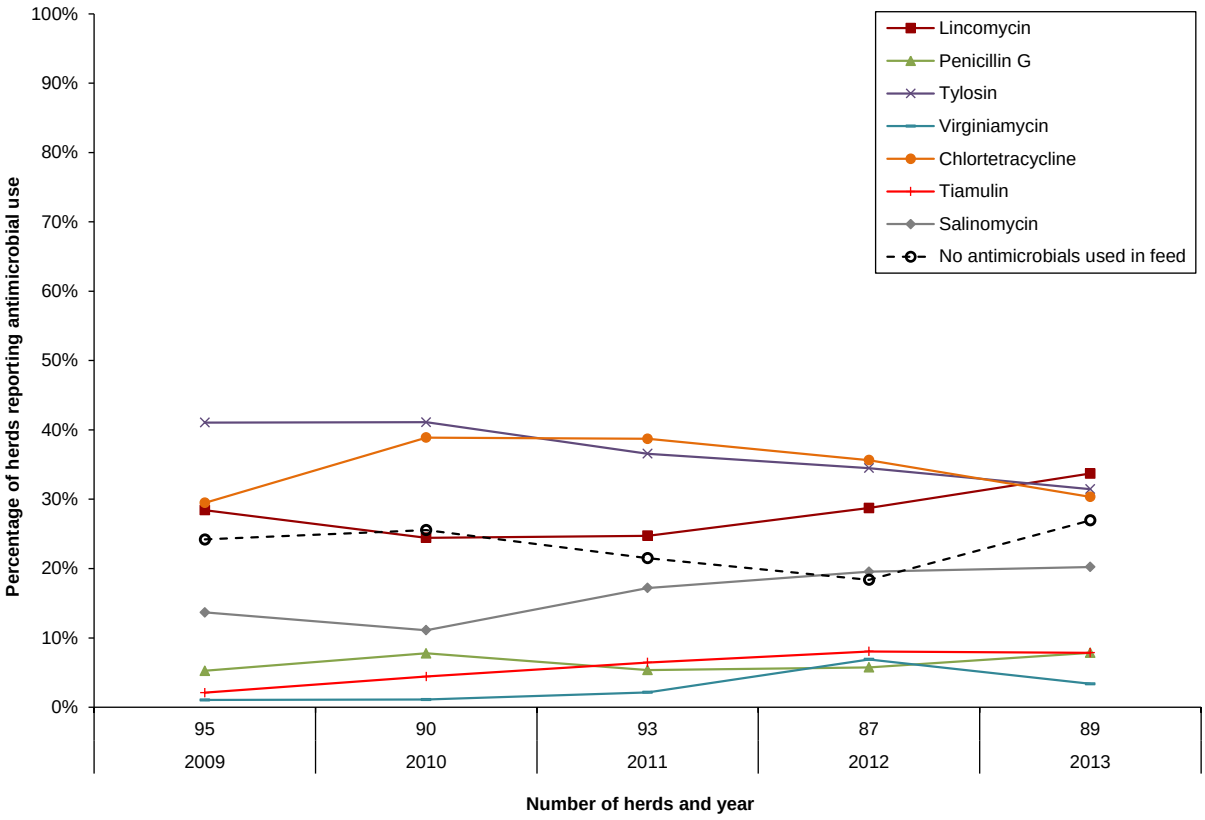
Table 2.3. Summary of antimicrobial use in feed, 2013

	Antimicrobial	Number of herds (%)	Number of rations (%)	Days exposed median (min. ; max.)	Percentage (%) of herd exposed median (min. ; max.)	Drug level in feed grams/tonne median (min. ; max.)	Antimicrobial consumption[a] grams/1,000 pig-days median (min. ; max.)
II	Lincomycin	30 (34)	59 (15)	22 (5 ; 56)	100 (50 ; 100)	44 (11 ; 220)	98 (31 ; 513)
	Penicillin	7 (8)	9 (2)	18 (4 ; 35)	100 (65 ; 100)	99 (55 ; 275)	90 (82 ; 241)
	Tiamulin	7 (8)	9 (2)	21 (3 ; 21)	100 (50 ; 100)	39 (18 ; 200)	69 (30 ; 414)
	Tilmicosin	3 (3)	3 (1)	14 (14 ; 14)	100 (100 ; 100)	200 (200 ; 200)	451 (448 ; 472)
	Tylosin	28 (31)	69 (18)	28 (1 ; 63)	100 (20 ; 100)	22 (11 ; 110)	61 (26 ; 297)
	Virginiamycin	3 (3)	7 (2)	21 (1 ; 21)	100 (100 ; 100)	22 (22 ; 22)	43 (37 ; 54)
III	Bacitracin	1 (1)	1 (0.25)	56 (56 ; 56)	100 (100 ; 100)	33 (33 ; 33)	91 (91 ; 91)
	Chlortetracycline	27 (30)	35 (9)	14 (3 ; 35)	100 (50 ; 100)	550 (33 ; 1100)	758 (49 ; 1,653)
	Sulfamethazine	3 (3)	3 (1)	35 (5 ; 35)	100 (65 ; 100)	110 (110 ; 110)	166 (163 ; 190)
IV	Flavomycin	1 (1)	2 (1)	35 (35 ; 35)	100 (100 ; 100)	500 (500 ; 500)	1,133 (994 ; 1,272)
	Salinomycin	18 (20)	61 (15)	27 (10 ; 49)	100 (50 ; 100)	25 (25 ; 60)	61 (37 ; 134)
	Unmedicated rations	59 (66)	144 (37)	28 (1 ; 126)	100 (30 ; 100)	N/A	N/A

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
N/A=not applicable
[a] Median antimicrobial consumption estimates were calculated using reported ration days fed and predicted feed intake[13], adjusted for herd average daily gain; only rations medicated with the specified antimicrobial were included in the analysis for each antimicrobial.

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

Figure 2.1. Percentage of pig herds reporting antimicrobial use in feed, 2009–2013



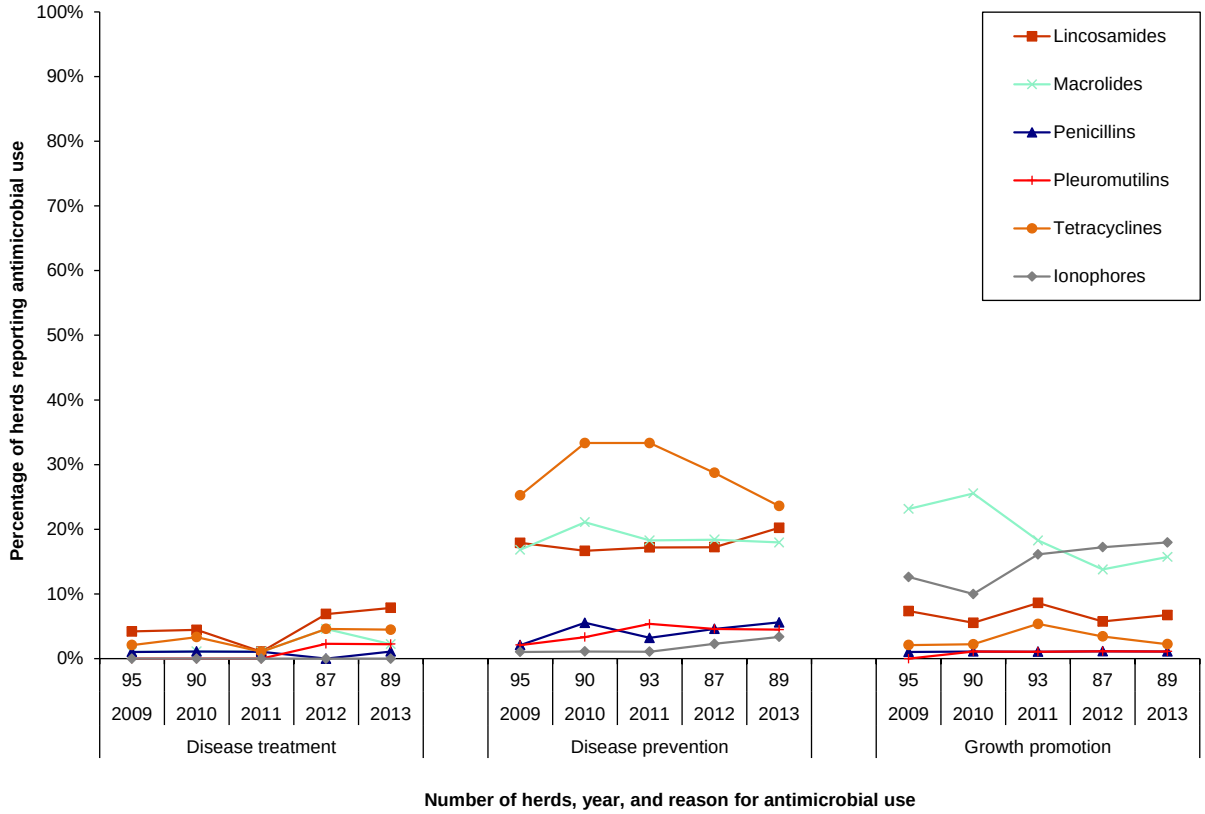
Year Number of herds	2009 95	2010 90	2011 93	2012 87	2013 89
Antimicrobial					
II Lincomycin	**28%**	24%	25%	**29%**	**34%**
II Penicillin	**5%**	8%	5%	**6%**	**8%**
II Tylosin	**41%**	41%	37%	**34%**	**31%**
II Virginiamycin	**1%**	2%	2%	**7%**	**3%**
III Chlortetracycline	**29%**	39%	39%	**36%**	**30%**
III Tiamulin	**2%**	4%	6%	**8%**	**8%**
IV Salinomycin	**14%**	12%	17%	**20%**	**20%**
No antimicrobials used in feed	**24%**	24%	22%	**18%**	**27%**

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

Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure. Antimicrobial use in feed reported by fewer than 5% of herds included: tilmicosin (Category II); bacitracin, neomycin, oxytetracycline, spectinomycin, and sulfamethazine (Category III); bambermycin (Category IV).

For the temporal analyses, the proportion (%) of herds using a specific antimicrobial in the current year has been compared to the proportion (%) of herds using the same antimicrobial in 2009 and the previous surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial.

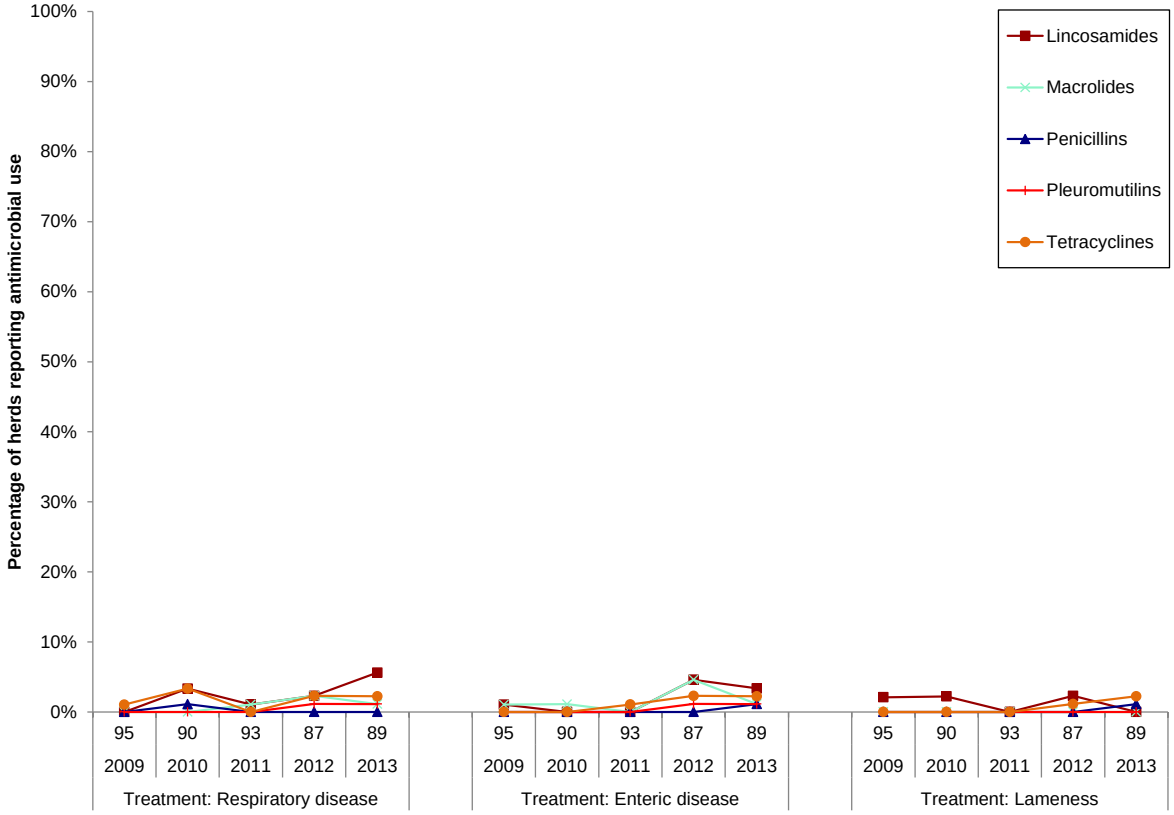
Figure 2.2. Percentage of pig herds reporting antimicrobial use in feed by primary reasons, 2009–2013



Reason for use		Disease treatment					Disease prevention					Growth promotion				
Year		2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Number of herds		95	90	93	87	89	95	90	93	87	89	95	90	93	87	89
Antimicrobial class																
II	Lincosamides	**4%**	4%	1%	**7%**	**8%**	**18%**	17%	17%	**17%**	**20%**	**7%**	6%	9%	**6%**	**7%**
II	Macrolides	**1%**	1%	1%	**5%**	**2%**	**17%**	21%	18%	**18%**	**18%**	**23%**	26%	18%	**14%**	**16%**
II	Penicillins	**1%**	1%	1%	**0%**	**1%**	**2%**	6%	3%	**5%**	**6%**	**1%**	1%	1%	**1%**	**1%**
III	Pleuromutilins	**0%**	0%	0%	**2%**	**2%**	**2%**	3%	5%	**5%**	**4%**	**0%**	1%	1%	**1%**	**1%**
III	Tetracyclines	**2%**	3%	1%	**5%**	**4%**	**25%**	33%	33%	**29%**	**24%**	**2%**	2%	5%	**3%**	**2%**
IV	Ionophores	**0%**	0%	0%	**0%**	**0%**	**1%**	1%	1%	**2%**	**3%**	**13%**	11%	16%	**17%**	**18%**

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Respondents were instructed to select only one of "Disease treatment", "Disease prevention" or "Growth promotion" as a primary reason for use of an antimicrobial.
Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure.
For the temporal analyses, the proportion (%) of herds using a specific antimicrobial class in the current year has been compared to the proportion (%) of herds using the same antimicrobial class in 2009 and the previous surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial class.

Figure 2.3. Percentage of pig herds reporting antimicrobial use in feed for *Disease Treatment*, 2009–2013



Reason for use	Treatment: Respiratory disease					Treatment: Enteric disease					Treatment: Lameness				
Year	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Number of herds	95	90	93	87	89	95	90	93	87	89	95	90	93	87	89
Antimicrobial class															
II Lincosamides	**0%**	3%	1%	**2%**	**6%**	**1%**	0%	0%	**5%**	**3%**	**2%**	2%	0%	**2%**	**0%**
II Macrolides	**0%**	0%	1%	**2%**	**1%**	**1%**	1%	0%	**5%**	**1%**	**0%**	0%	0%	**0%**	**0%**
II Penicillins	**0%**	1%	0%	**0%**	**0%**	**0%**	0%	0%	**0%**	**1%**	**0%**	0%	0%	**0%**	**1%**
III Pleuromutilins	**0%**	0%	0%	**1%**	**1%**	**0%**	0%	0%	**1%**	**1%**	**0%**	0%	0%	**0%**	**0%**
III Tetracyclines	**1%**	3%	0%	**2%**	**2%**	**0%**	0%	1%	**2%**	**2%**	**0%**	0%	0%	**1%**	**2%**

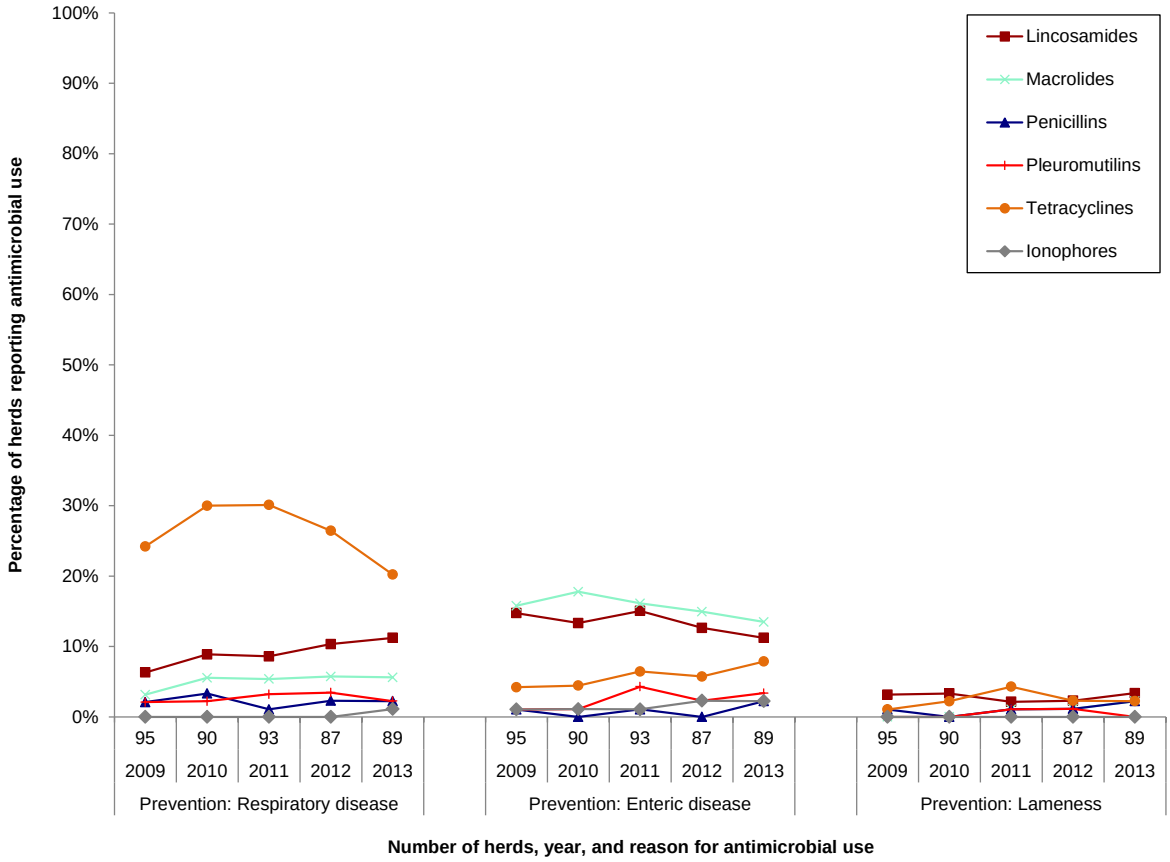
Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

Respondents were instructed to "Check all that apply" from a list of secondary reasons for an antimicrobial use under "Treatment": "Respiratory disease", "Enteric disease", "Lameness", and "Other".

Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure.

For the temporal analyses, the proportion (%) of herds using a specific antimicrobial class in the current year has been compared to the proportion (%) of herds using the same antimicrobial class in 2009 and the previous surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial class.

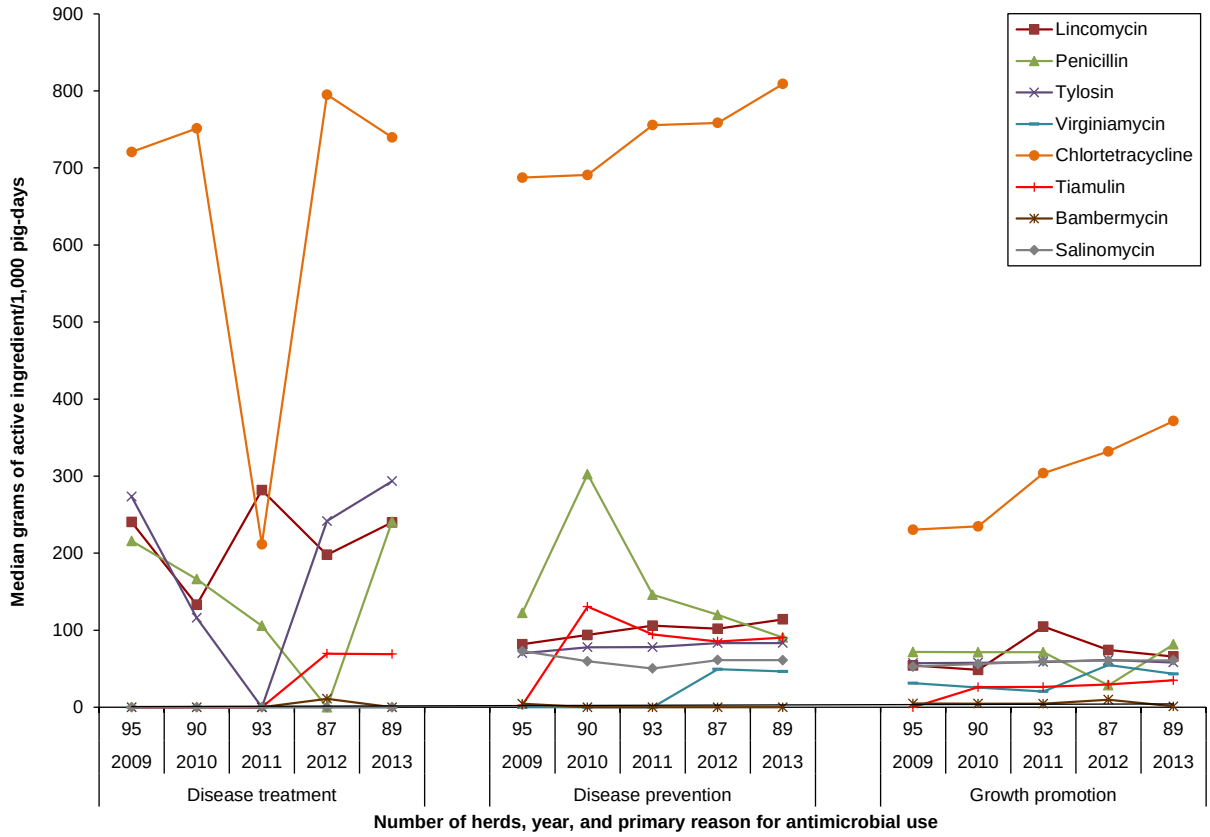
Figure 2.4. Percentage of pig herds reporting antimicrobial use in feed for *Disease Prevention*, 2009–2013



Reason for use		Prevention: Respiratory disease					Prevention: Enteric disease					Prevention: Lameness				
Year		2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Number of herds		95	90	93	87	89	95	90	93	87	89	95	90	93	87	89
Antimicrobial class																
II	Lincosamides	6%	9%	9%	10%	11%	15%	13%	15%	13%	11%	3%	3%	2%	2%	3%
II	Macrolides	3%	6%	5%	6%	6%	16%	18%	16%	15%	13%	0%	0%	1%	1%	2%
II	Penicillins	2%	3%	1%	2%	2%	1%	0%	1%	0%	2%	1%	0%	1%	1%	2%
III	Pleuromutilins	2%	2%	3%	3%	2%	1%	1%	4%	2%	3%	0%	0%	1%	1%	0%
III	Tetracyclines	24%	30%	30%	26%	20%	4%	4%	6%	6%	8%	1%	2%	4%	2%	2%
IV	Ionophores	0%	0%	0%	0%	1%	1%	1%	1%	2%	2%	0%	0%	0%	0%	0%

Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Respondents were instructed to "Check all that apply" from a list of secondary reasons for an antimicrobial use under "Prevention": "Respiratory disease", "Enteric disease", "Lameness", and "Other".
Only antimicrobial classes used by 5% of herds or more in a given year are depicted in this figure.
For the temporal analyses, the proportion (%) of herds using a specific antimicrobial in the current year has been compared to the proportion (%) of herds using the same antimicrobial class in 2009 and the previous surveillance year (grey areas). The presence of blue areas indicates significant differences ($P \leq 0.05$) for a given antimicrobial class.

Figure 2.5. Quantity of antimicrobials used in feed by reason for use, 2009–2013



Reason for use		Disease treatment					Disease prevention					Growth promotion				
Year		2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Number of herds		95	90	93	87	89	95	90	93	87	89	95	90	93	87	89
Antimicrobial		Median grams/1,000 pig-days[a] (number of rations medicated)														
II	Lincomycin	240 (9)	133 (5)	282 (2)	198 (10)	240 (11)	82 (35)	94 (34)	106 (31)	102 (26)	114 (31)	54 (28)	48 (15)	105 (18)	74 (15)	66 (14)
	Penicillin	216 (1)	166 (1)	106 (1)	0	241 (1)	122 (2)	303 (6)	146 (4)	120 (4)	90 (4)	72 (1)	72 (1)	72 (1)	29 (1)	82 (1)
	Tylosin	273 (1)	116 (5)	0	242 (7)	293 (1)	70 (40)	78 (30)	78 (47)	83 (33)	83 (31)	57 (58)	58 (56)	59 (52)	61 (39)	58 (37)
	Virginiamycin	0	0	0	0	0	0	0	0	49 (3)	47 (2)	31 (1)	26 (2)	21 (5)	55 (8)	43 (5)
III	Chlortetracycline	721 (2)	751 (3)	212 (1)	795 (4)	740 (5)	687 (24)	691 (32)	756 (36)	758 (30)	809 (27)	230 (2)	235 (2)	304 (5)	332 (3)	372 (3)
	Tiamulin	0	0	0	70 (3)	69 (3)	3 (2)	131 (4)	94 (5)	85 (4)	91 (4)	0	26 (1)	26 (1)	30 (1)	35 (2)
IV	Bambermycin	0	0	0	11 (1)	0	5 (2)	0	0	0	0	5 (7)	5 (2)	5 (2)	10 (1)	1 (2)
	Salinomycin	0	0	0	0	0	73 (1)	60 (1)	50 (4)	61 (7)	61 (7)	53 (33)	56 (26)	60 (50)	61 (49)	61 (54)

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

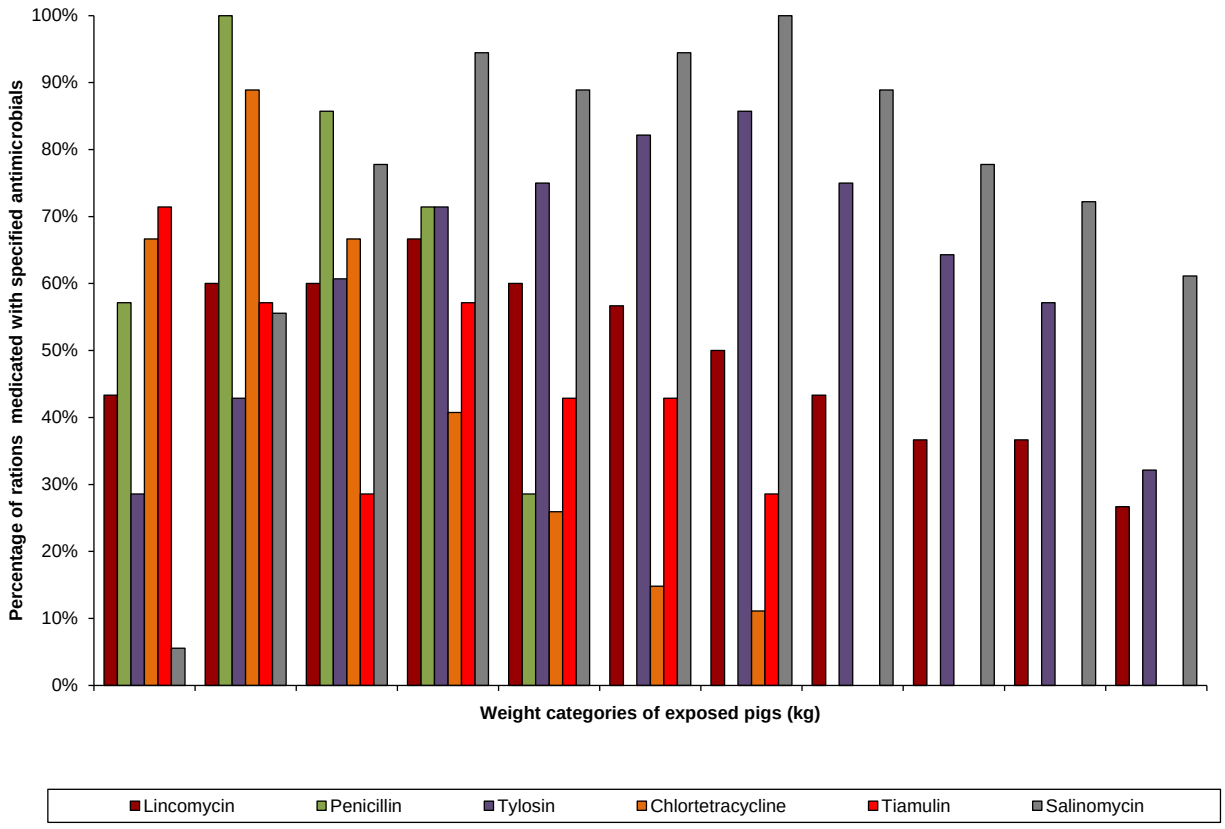
Respondents were instructed to select only one of "Disease treatment", "Disease prevention" or "Growth promotion" as a primary reason for use of an antimicrobial.

Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure.

[a] Median antimicrobial consumption estimates were calculated using reported ration days fed and predicted feed intake[14], adjusted for herd average daily gain; only rations medicated with the specified antimicrobial were included in the analysis for each antimicrobial.

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

Figure 2.6. Percentage of rations medicated with specified antimicrobials fed over the grow-finish period by reported pig weights, 2013



	Antimicrobial	Number of medicated rations	Pig weight categories over the grow-finish period (kg)										
			15–29	30–39	40–49	50–59	60–69	70–79	80–89	90–99	100–109	110–119	> 119
II	Lincomycin	30	43%	60%	60%	67%	60%	57%	50%	43%	37%	37%	27%
II	Penicillin	7	57%	100%	86%	71%	29%	0%	0%	0%	0%	0%	0%
II	Tylosin	28	29%	43%	61%	71%	75%	82%	86%	75%	64%	57%	32%
III	Chlortetracycline	27	67%	89%	67%	41%	26%	15%	11%	0%	0%	0%	0%
III	Tiamulin	7	71%	57%	29%	57%	43%	43%	29%	0%	0%	0%	0%
IV	Salinomycin	18	6%	56%	78%	94%	89%	94%	100%	89%	78%	72%	61%

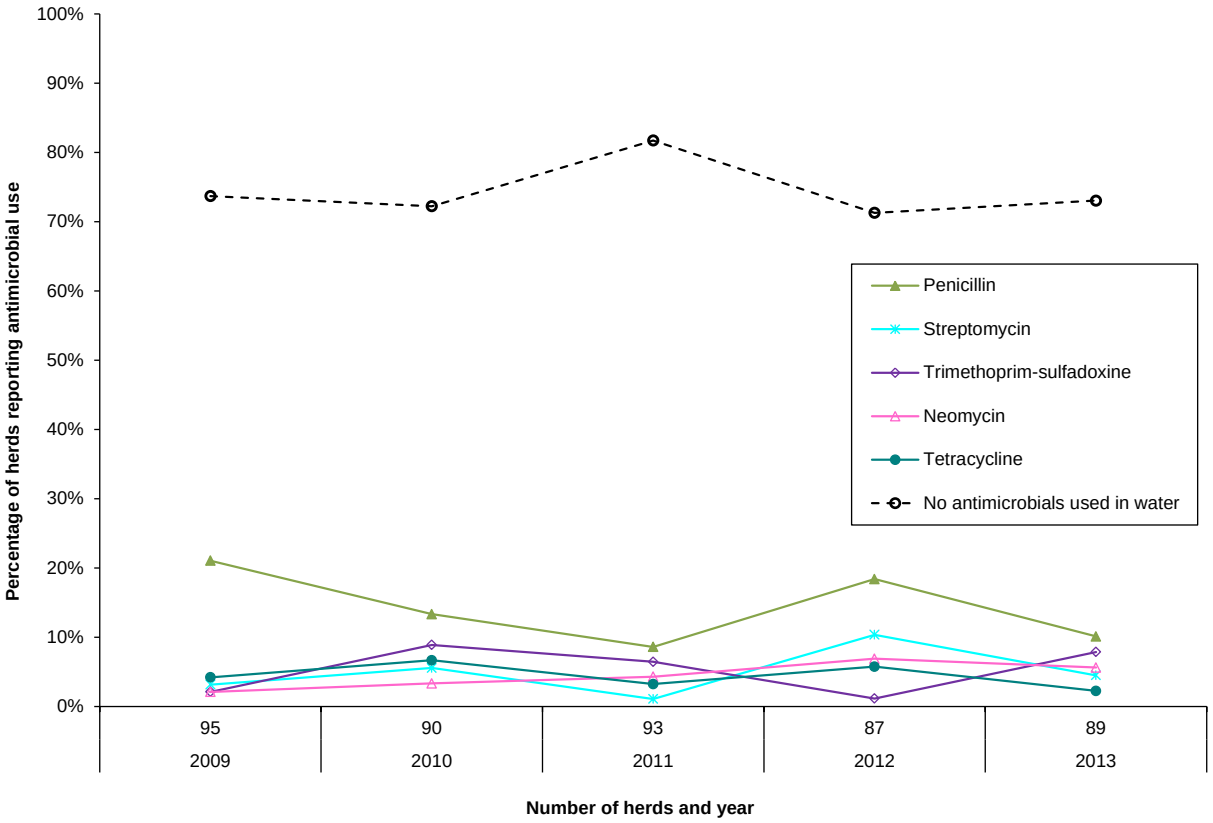
Roman numerals II to IV indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.

Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure.

Antimicrobials used in medicated rations by fewer than 5% of herds included: tilmicosin and virginiamycin (Category II); bacitracin and sulfamethazine (Category III); bambermycin (Category IV).

ANTIMICROBIAL USE IN WATER

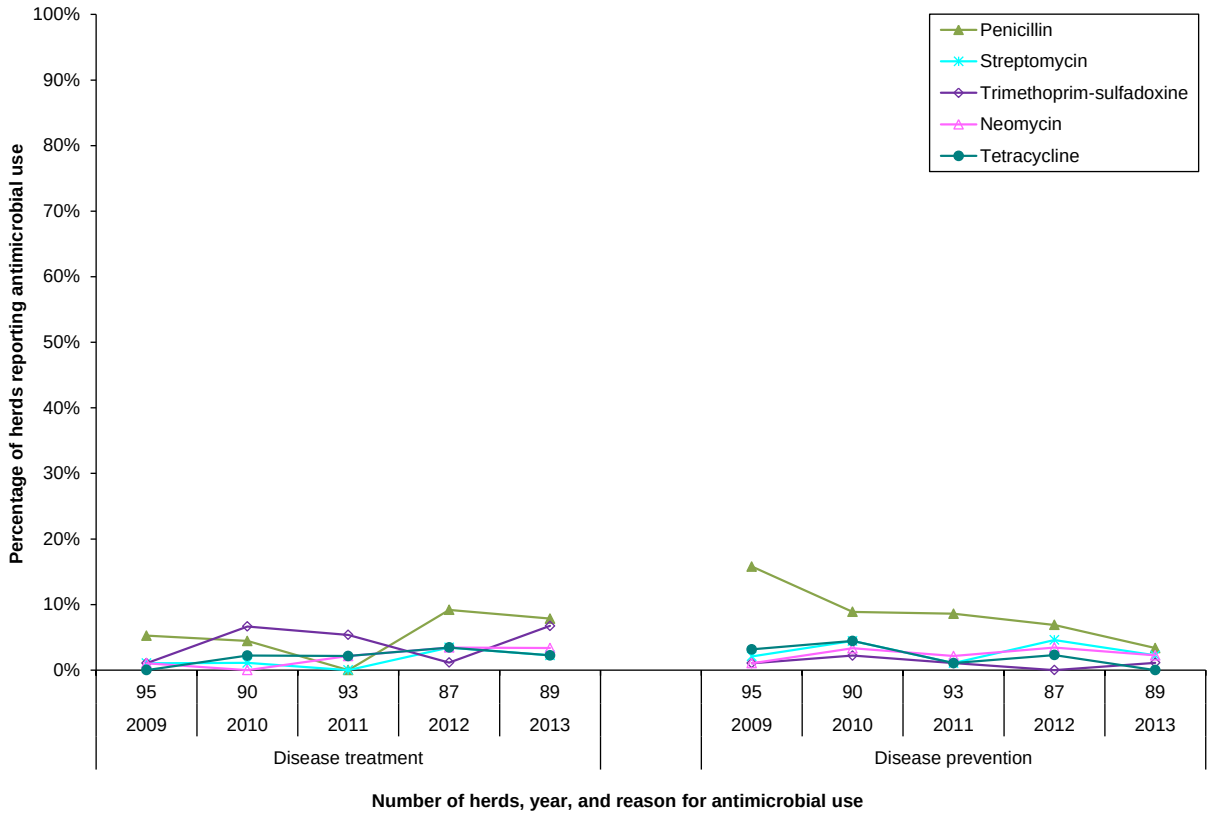
Figure 2.7. Percentage of pig herds reporting antimicrobial use in water, 2009–2013



Year	2009	2010	2011	2012	2013
Number of herds	95	90	93	87	89
Antimicrobial					
II Penicillin	21%	13%	9%	18%	10%
II Streptomycin	3%	4%	1%	10%	4%
II Trimethoprim-sulfadoxine	2%	9%	6%	1%	8%
III Neomycin	2%	4%	4%	7%	6%
III Tetracycline	4%	7%	3%	6%	2%
No antimicrobials used in water	74%	72%	82%	71%	73%

Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure.
Antimicrobial use in water reported by fewer than 5% of herds included: lincomycin (Category II); sulfonamides (Category III).

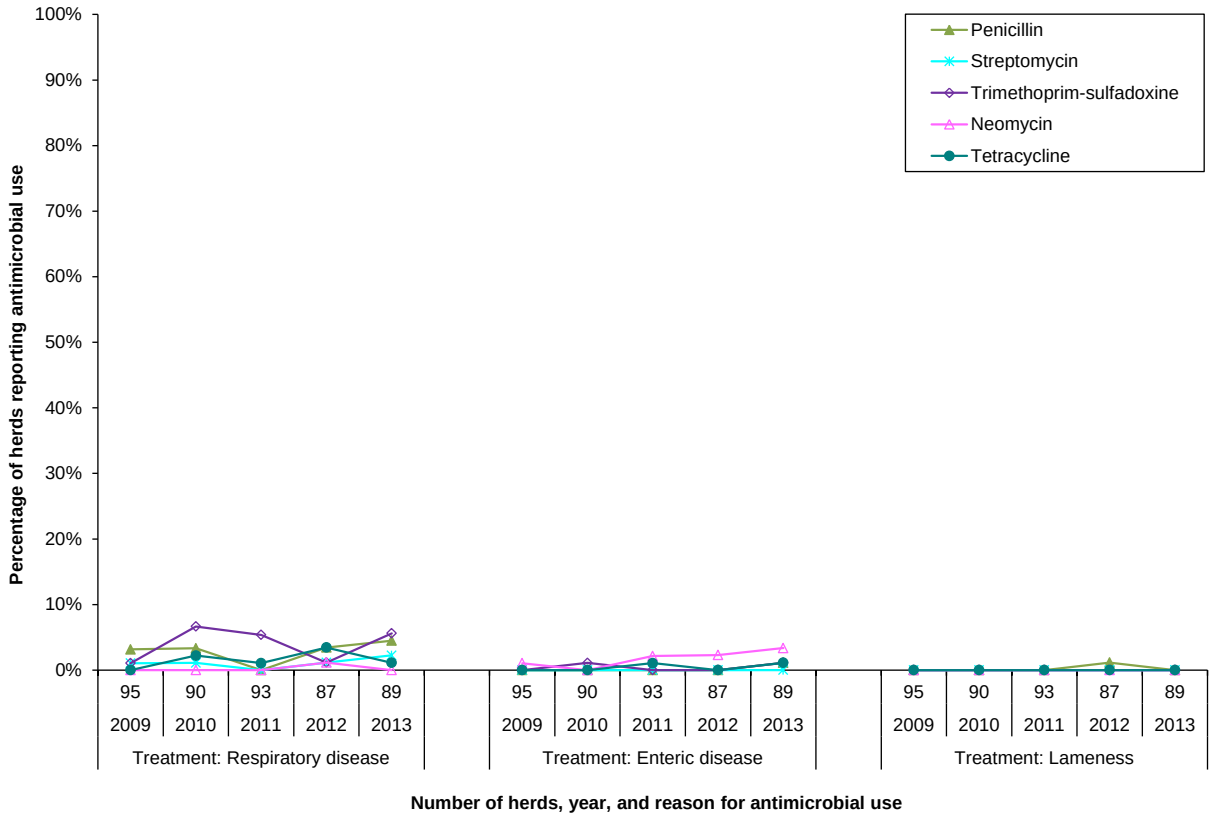
Figure 2.8. Percentage of pig herds reporting antimicrobial use in water by primary reasons, 2009–2013



Reason for use		Disease treatment					Disease prevention				
Year		2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Number of herds		95	90	93	87	89	95	90	93	87	89
Antimicrobial											
II	Penicillin	5%	6%	0%	9%	8%	16%	8%	9%	7%	3%
II	Streptomycin	1%	1%	0%	3%	2%	2%	3%	1%	5%	2%
II	Trimethoprim-sulfadoxine	1%	7%	5%	1%	7%	1%	2%	1%	0%	1%
III	Neomycin	1%	1%	2%	3%	3%	1%	3%	2%	3%	2%
III	Tetracycline	0%	2%	2%	3%	2%	3%	4%	1%	2%	0%

Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Respondents were instructed to select either "Disease treatment" or "Disease prevention" as a primary reason for use of an antimicrobial.
Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure.
Antimicrobial use in water reported by fewer than 5% of herds included: lincomycin (Category II); sulfonamides (Category III).

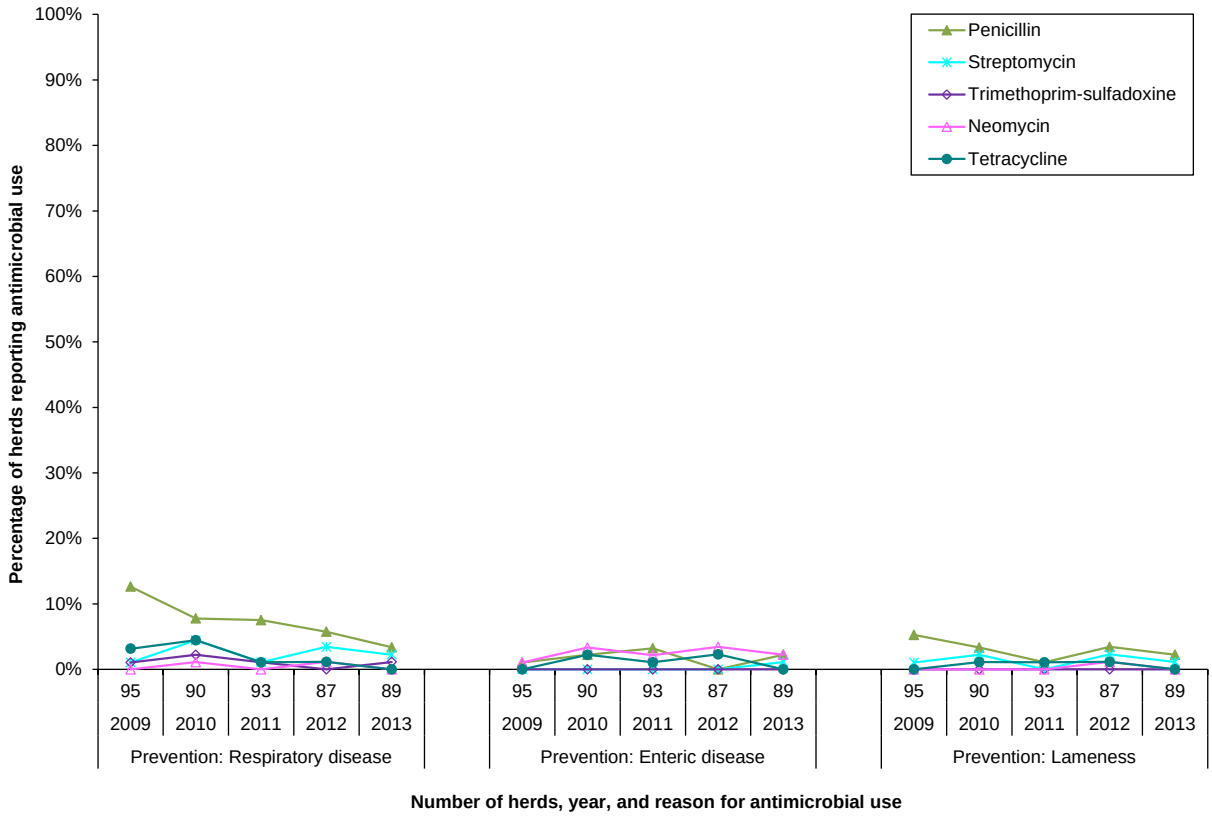
Figure 2.9. Percentage of pig herds reporting antimicrobial use in water by reasons for use for *Disease Treatment*, 2009–2013



Reason for use		Treatment: Respiratory disease					Treatment: Enteric disease					Treatment: Lameness				
Year		2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Number of herds		95	90	93	87	89	95	90	93	87	89	95	90	93	87	89
Antimicrobial																
	Penicillin	3%	4%	0%	3%	4%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%
II	Streptomycin	1%	1%	0%	1%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Trimethoprim-sulfadoxine	1%	7%	5%	1%	6%	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%
III	Neomycin	0%	0%	0%	1%	0%	1%	1%	2%	2%	3%	0%	0%	0%	0%	0%
	Tetracycline	0%	2%	1%	3%	1%	0%	0%	1%	0%	1%	0%	0%	0%	0%	0%

Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Respondents were instructed to "Check all that apply" from a list of secondary reasons for an antimicrobial use under "Treatment": "Respiratory disease", "Enteric disease", "Lameness", and "Other"
Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure.
Antimicrobial use in water reported by fewer than 5% of herds included: lincomycin (Category II); sulfonamides (Category III).

Figure 2.10. Percentage of pig herds reporting antimicrobial use in water by reasons for use for *Disease Prevention*, 2009–2013



Reason for use		Prevention: Respiratory disease					Prevention: Enteric disease					Prevention: Lameness				
Year		2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Number of herds		95	90	93	87	89	95	90	93	87	89	95	90	93	87	89
Antimicrobial																
	Penicillin	13%	8%	8%	6%	3%	1%	2%	3%	0%	2%	5%	3%	1%	3%	2%
II	Streptomycin	1%	4%	1%	3%	2%	0%	0%	0%	0%	1%	1%	2%	0%	2%	1%
	Trimethoprim-sulfadoxine	1%	2%	1%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
III	Neomycin	0%	1%	0%	1%	0%	1%	3%	2%	3%	2%	0%	0%	0%	1%	0%
	Tetracycline	3%	4%	1%	1%	0%	0%	2%	1%	2%	0%	0%	1%	1%	1%	0%

Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Respondents were instructed to "Check all that apply" from a list of secondary reasons for an antimicrobial use under "Prevention": "Respiratory disease", "Enteric disease", "Lameness", and "Other".
Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure.
Antimicrobial use in water reported by fewer than 5% of herds included: lincomycin (Category II); sulfonamides (Category III).

Table 2.4. Frequency of antimicrobial use in water by the proportion of pigs exposed, 2009–2013

Antimicrobial		Proportion of pigs exposed				Total
		1–25%	26–50%	51–75%	76–100%	
		Number of medicated water uses (% of total)				
II	Lincomycin	0 (0)	1 (1)	0 (0)	2 (1)	**3 (2)**
	Penicillin	1 (1)	6 (3)	2 (1)	58 (32)	**67 (37)**
	Streptomycin	1 (1)	2 (1)	0 (0)	19 (10)	**22 (12)**
	Trimethoprim	0 (0)	3 (2)	1 (1)	20 (11)	**24 (13)**
III	Neomycin	0 (0)	0 (0)	1 (1)	20 (13)	**20 (11)**
	Spectinomycin	0 (0)	0 (0)	0 (0)	2 (1)	**2 (1)**
	Sulfonamides	1 (1)	0 (0)	0 (0)	4 (2)	**5 (3)**
	Tetracycline	0 (0)	0 (0)	0 (0)	20 (11)	**20 (11)**
Other		3 (2)	1 (1)	0 (0)	14 (9)	**18 (10)**
Total		**6 (3)**	**13 (7)**	**4 (2)**	**159 (87)**	**182 (100)**

Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
"Other" water antimicrobials included: ampicillin (3), neomycin-penicillin (1), tiamulin (7), tilmicosin (4), and tylvalosin (2).

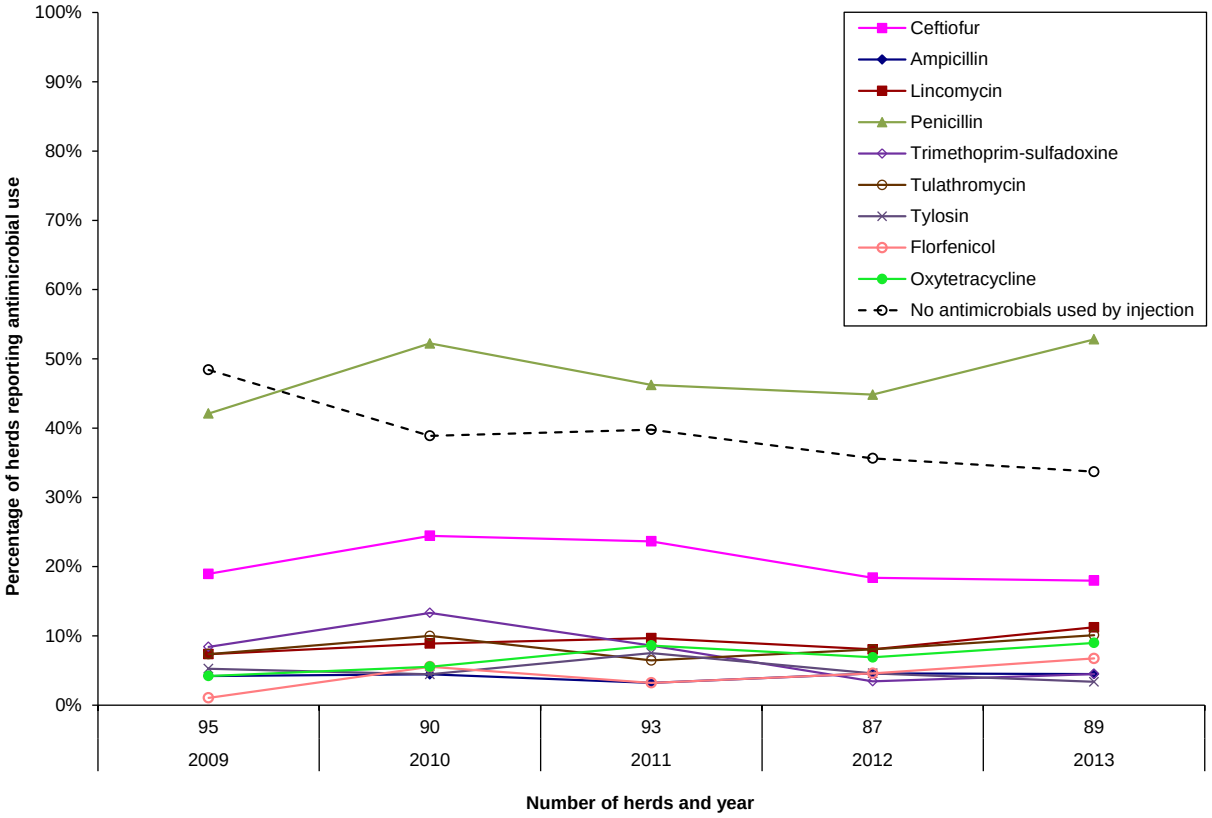
Table 2.5. Frequency of antimicrobial use in water by the proportion of pigs exposed, 2013

Antimicrobial		Proportion of pigs exposed				Total
		1–25%	26–50%	51–75%	76–100%	
		Number of medicated water uses (% of total)				
II	Lincomycin	0 (0)	0 (0)	0 (0)	1 (3)	**1 (3)**
	Penicillin	1 (3)	1 (3)	0 (0)	8 (20)	**10 (26)**
	Streptomycin	1 (3)	0 (0)	0 (0)	3 (8)	**4 (10)**
	Trimethoprim-sulfadioxine	0 (0)	1 (3)	1 (3)	5 (13)	**7 (18)**
III	Neomycin	0 (0)	0 (0)	0 (0)	6 (19)	**6 (15)**
	Spectinomycin	0 (0)	0 (0)	0 (0)	1 (3)	**1 (3)**
	Sulfonamides	0 (0)	0 (0)	0 (0)	1 (3)	**1 (3)**
	Tetracycline	0 (0)	0 (0)	0 (0)	2 (5)	**2 (5)**
Other		1 (3)	1 (3)	0 (0)	5 (13)	**7 (18)**
Total		**3 (8%)**	**3 (8%)**	**1 (3%)**	**32 (82%)**	**39 (100%)**

Roman numerals II to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
"Other" water antimicrobials included: ampicillin (1), tilmicosin (4), and tylvalosin (2).

ANTIMICROBIAL USE BY INJECTION

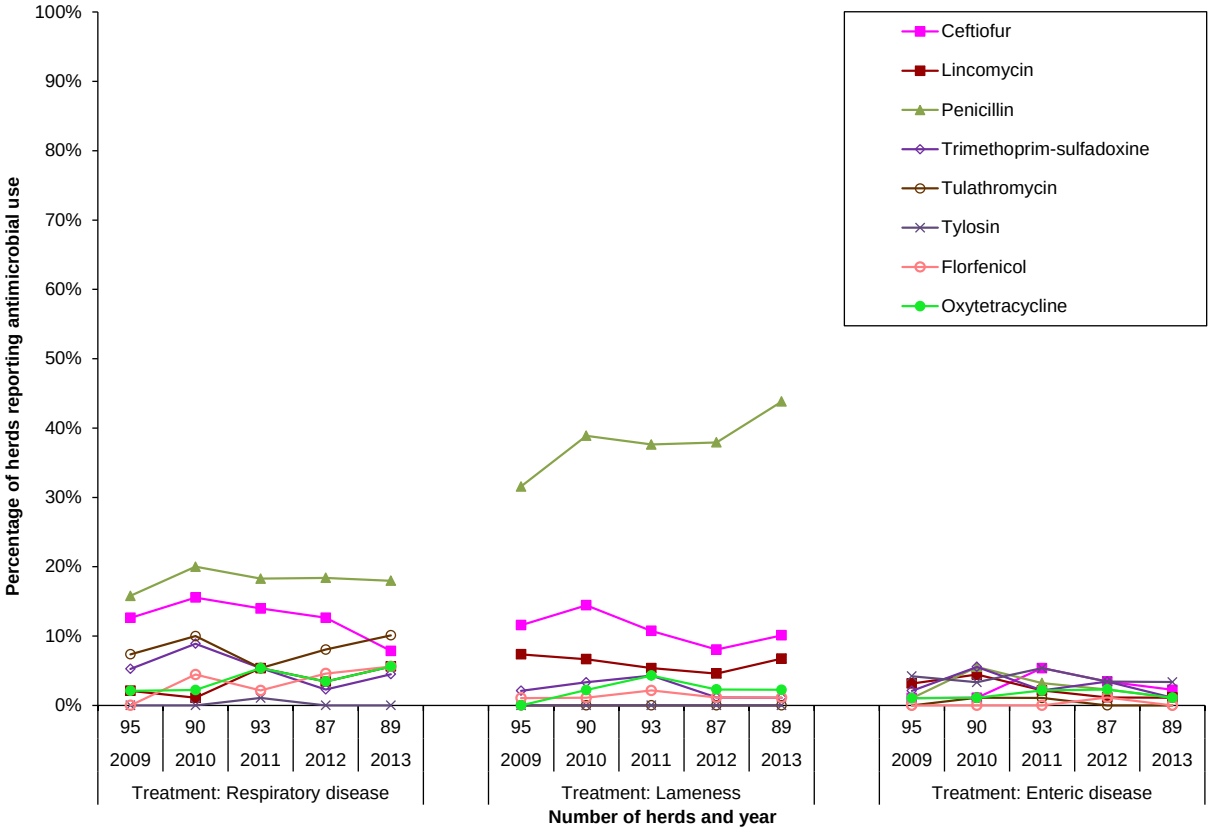
Figure 2.11. Percentage of pig herds reporting antimicrobial use by injection, 2009–2013



Year	2009	2010	2011	2012	2013
Number of herds	95	90	93	87	89
Antimicrobial					
I Ceftiofur	20%	24%	24%	18%	18%
I Ampicillin	4%	4%	3%	5%	4%
II Lincomycin	8%	9%	10%	8%	11%
II Penicillin	41%	51%	46%	45%	53%
II Trimethoprim-sulfadoxine	9%	13%	9%	3%	4%
II Tulathromycin	8%	10%	6%	8%	10%
II Tylosin	5%	4%	8%	5%	3%
III Florfenicol	1%	6%	3%	5%	7%
III Oxytetracycline	4%	6%	9%	7%	9%
No antimicrobials used by injection	47%	40%	40%	36%	34%

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure.

Figure 2.12. Percentage of pig herds reporting antimicrobial use by injection, by reasons for use under *Disease Treatment*, 2009–2013



Reason for use	Treatment: Respiratory disease					Treatment: Lameness					Treatment: Enteric disease				
Year	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Number of herds	95	90	93	87	89	95	90	93	87	89	95	90	93	87	89
Antimicrobial															
I Ceftiofur	13%	16%	14%	13%	8%	12%	14%	11%	8%	10%	1%	1%	5%	3%	2%
II Lincomycin	2%	1%	5%	3%	6%	7%	7%	5%	5%	7%	3%	4%	2%	1%	1%
II Penicillin	16%	20%	18%	18%	18%	32%	38%	38%	38%	44%	1%	6%	3%	2%	1%
II Trimethoprim-sulfadoxine	5%	9%	5%	2%	4%	2%	3%	4%	1%	1%	2%	6%	2%	3%	1%
II Tulathromycin	7%	10%	5%	8%	10%	0%	0%	0%	0%	0%	0%	1%	1%	0%	0%
II Tylosin	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	4%	3%	5%	3%	3%
III Florfenicol	0%	4%	2%	5%	6%	1%	1%	2%	1%	1%	0%	0%	0%	1%	0%
III Oxytetracycline	2%	2%	5%	3%	6%	0%	2%	4%	2%	2%	1%	1%	2%	2%	1%

Roman numerals I to III indicate categories of importance to human medicine as outlined by the Veterinary Drugs Directorate.
Respondents were instructed to "Check all that apply" from a list of reasons for an antimicrobial use: "Respiratory disease", "Enteric disease", "Lameness", and "Other".
Only antimicrobials used by 5% of herds or more in a given year are depicted in this figure.
Antimicrobials used by fewer than 5 % of herds included: ampicillin, erythromycin, and tiamulin (Category II); spectinomycin (Category III).

Table 2.6. Frequency of antimicrobial treatments by injection, by the proportion of pigs exposed, 2009–2013

	Antimicrobial	Proportion of pigs exposed					Total
		< 5%	6–25%	26–50%	51–75%	76–100%	
		Number of uses by injection (% of total)					
I	Ceftiofur	87 (17)	6 (1)	0 (0)	0 (0)	1 (0)	**94 (18)**
	Enrofloxacin	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (0)**
II	Ampicillin	18 (3)	1 (0)	0 (0)	0 (0)	0 (0)	**19 (4)**
	Erythromycin	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (0)**
	Lincomycin	40 (8)	1 (0)	0 (0)	0 (0)	0 (0)	**41 (8)**
	Penicillin	203 (39)	10 (2)	1 (0)	2 (0)	0 (0)	**216 (41)**
	Tiamulin	2 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**2 (0)**
	Trimethoprim-sulfadoxine	31 (6)	4 (1)	0 (0)	0 (0)	0 (0)	**35 (7)**
	Tulathromycin	36 (7)	2 (0)	0 (0)	0 (0)	0 (0)	**38 (7)**
	Tylosin	23 (4)	0 (0)	0 (0)	0 (0)	0 (0)	**23 (4)**
III	Florfenicol	16 (3)	3 (1)	0 (0)	0 (0)	0 (0)	**19 (4)**
	Oxytetracycline	30 (6)	1 (0)	0 (0)	0 (0)	0 (0)	**31 (6)**
	Spectinomycin	2 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**2 (0)**
	Total	**490 (94)**	**28 (5)**	**1 (0)**	**2 (0)**	**1 (0)**	**522 (100)**

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

Table 2.7. Frequency of antimicrobial treatments by injection, by the proportion of pigs exposed, 2013

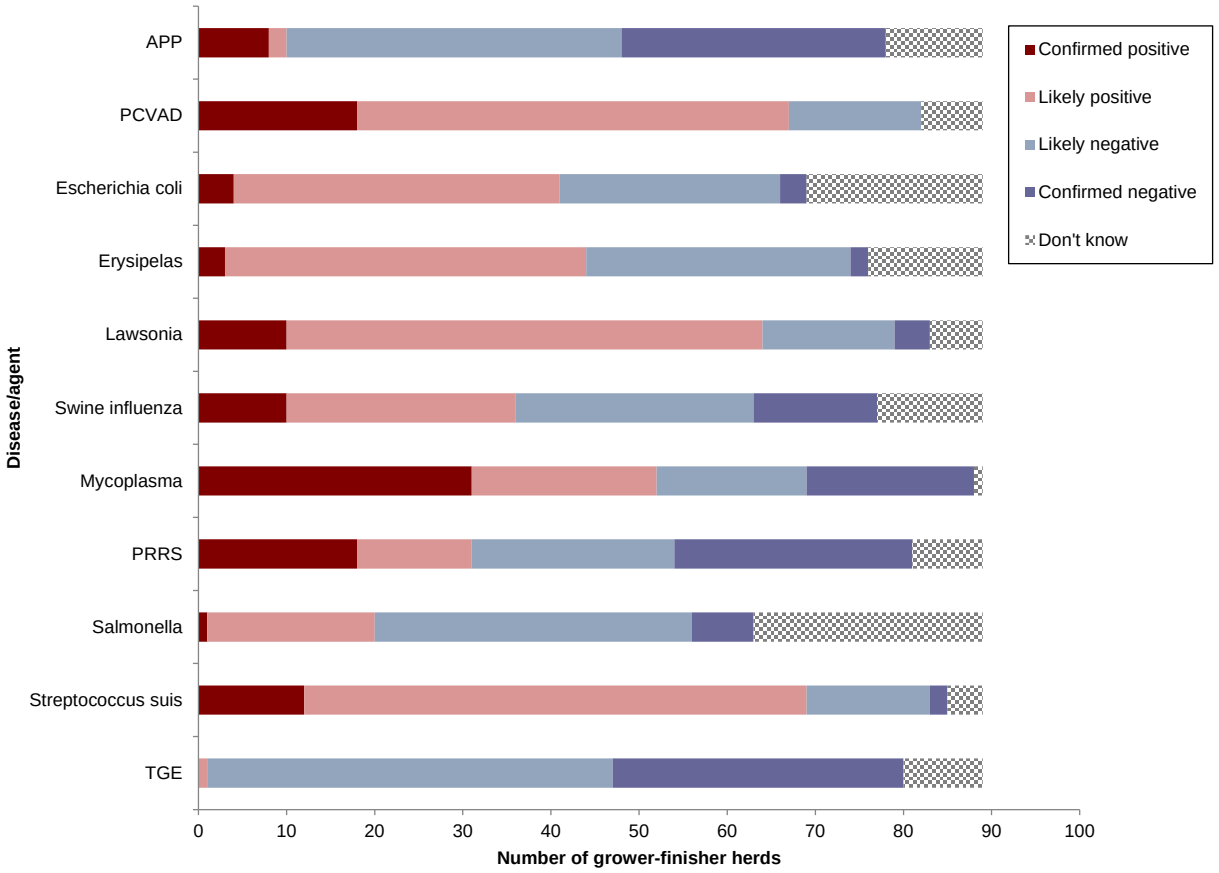
	Antimicrobial	Proportion of pigs exposed					Total
		< 5%	6–25%	26–50%	51–75%	76–100%	
		Number of uses by injection (% of total)					
I	Ceftiofur	16 (15)	0 (0)	0 (0)	0 (0)	0 (0)	**16 (15)**
	Enrofloxacin	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (1)**
II	Ampicillin	3 (3)	1 (1)	0 (0)	0 (0)	0 (0)	**4 (4)**
	Lincomycin	10 (9)	0 (0)	0 (0)	0 (0)	0 (0)	**10 (9)**
	Penicillin	45 (41)	1 (1)	0 (0)	1 (1)	0 (0)	**47 (43)**
	Trimethoprim-sulfadoxine	3 (3)	1 (1)	0 (0)	0 (0)	0 (0)	**4 (4)**
	Tulathromycin	9 (8)	0 (0)	0 (0)	0 (0)	0 (0)	**9 (8)**
	Tylosin	3 (3)	0 (0)	0 (0)	0 (0)	0 (0)	**3 (3)**
III	Florfenicol	6 (5)	0 (0)	0 (0)	0 (0)	0 (0)	**6 (5)**
	Oxytetracycline	7 (6)	1 (1)	0 (0)	0 (0)	0 (0)	**8 (7)**
	Spectinomycin	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (1)**
	Total	**104 (95)**	**4 (4)**	**0 (0)**	**1 (1)**	**0 (0)**	**109 (100)**

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

ANIMAL HEALTH AND BIOSECURITY

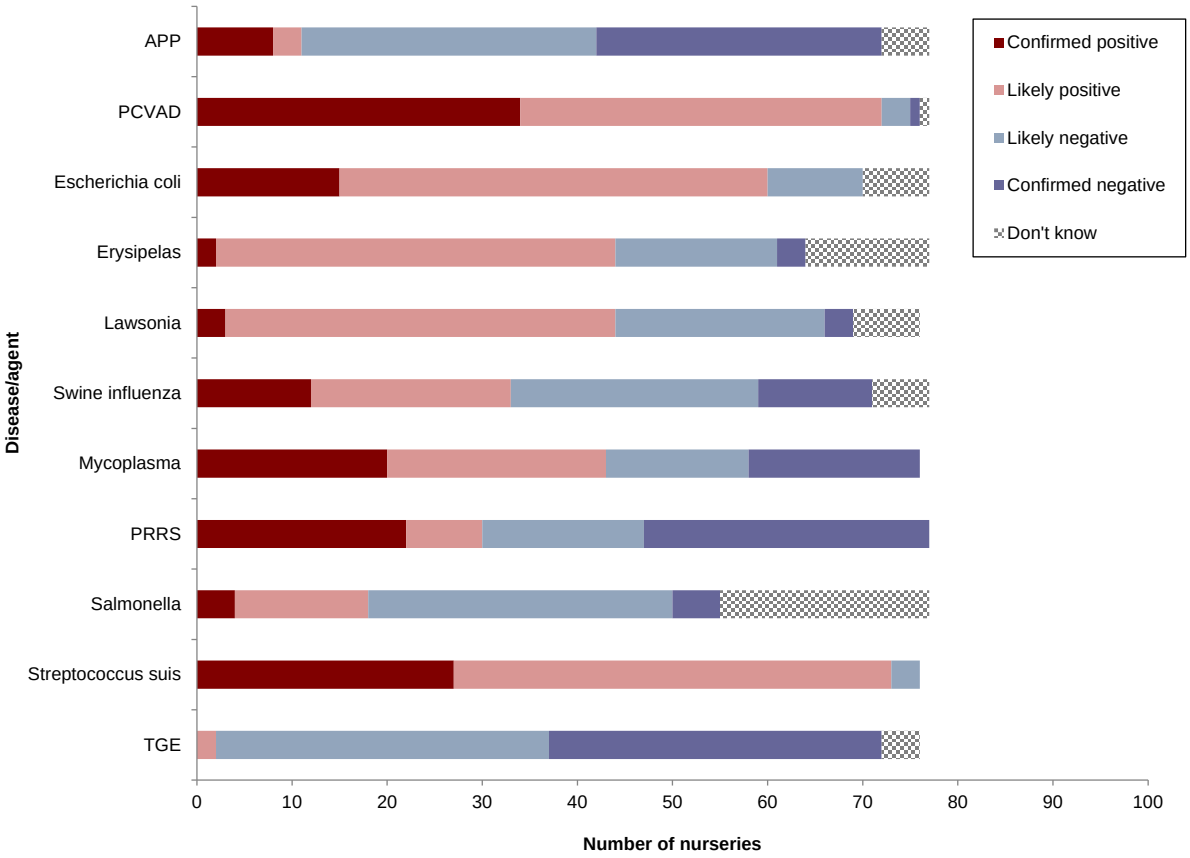
- The diseases most commonly reported as confirmed or likely positive in grower-finisher herds in 2013 were *Streptococcus suis* (82%, 69/85), Porcine Circovirus Associated Disease (PCVAD) (82%, 67/82), and *Lawsonia* (77%, 64/83) (Figure 2.13).
- The diseases most commonly reported as confirmed or likely positive in nursery herds associated with these grower-finisher herds in 2013 were *Streptococcus suis* (73/76, 96%), PCVAD (95%, 72/76), and *Escherichia coli* (86%, 60/70) (Figure 2.14).
- Over 75% of the sow herds associated with these grower-finisher herds in 2013 reported as confirmed or likely positive to *E. coli, Erysipelas, Lawsonia*, PCVAD, and *Streptococcus suis* (Figure 2.15).
- Antimicrobials were most commonly used for *Streptococcus suis*, *E. coli*, and *Mycoplasma* in nurseries, and *Streptococcus suis*, *Mycoplasma*, and *Lawsonia* in grower-finisher herds (Figure 2.21).
- Vaccination for PCVAD in grower-finisher herds decreased from 46% of herds in 2009 to 16% in 2013 but was over 90% in nurseries for the entire 2009 to 2013 period. Vaccination for Lawsonia in nurseries increased from 10% in 2009 to 26% in 2013 (Figure 2.22).
- In 2013, half of grower-finisher herds (51%, 45/89) reported at least 1 other pig farm within 2 kilometres of their farm.

Figure 2.13. Reported health status of grower-finisher herds, 2013



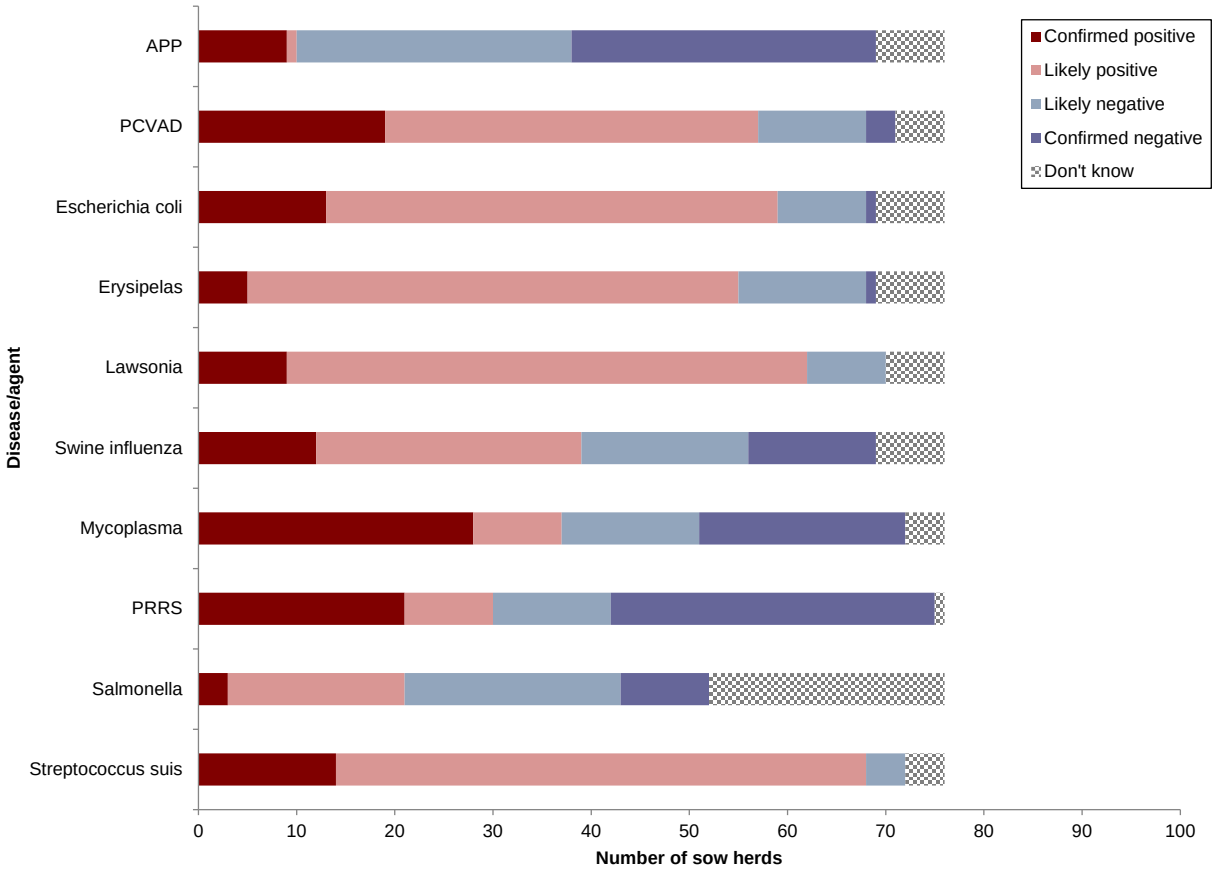
APP = *Actinobacillus pleuropneumoniae*
PCVAD = Porcine Circovirus Associated Disease
PRRS = Porcine Reproductive and Respiratory Syndrome
TGE = Transmissible gastroenteritis
Other disease reported in grower-finisher herds included: *Actinobacillus suis*, *Brachyspira*, *Hemophilus parasuis*, and *Mycoplasma hyosynoviae*.

Figure 2.14. Reported health status of nurseries supplying pigs to grower-finisher herds, 2013



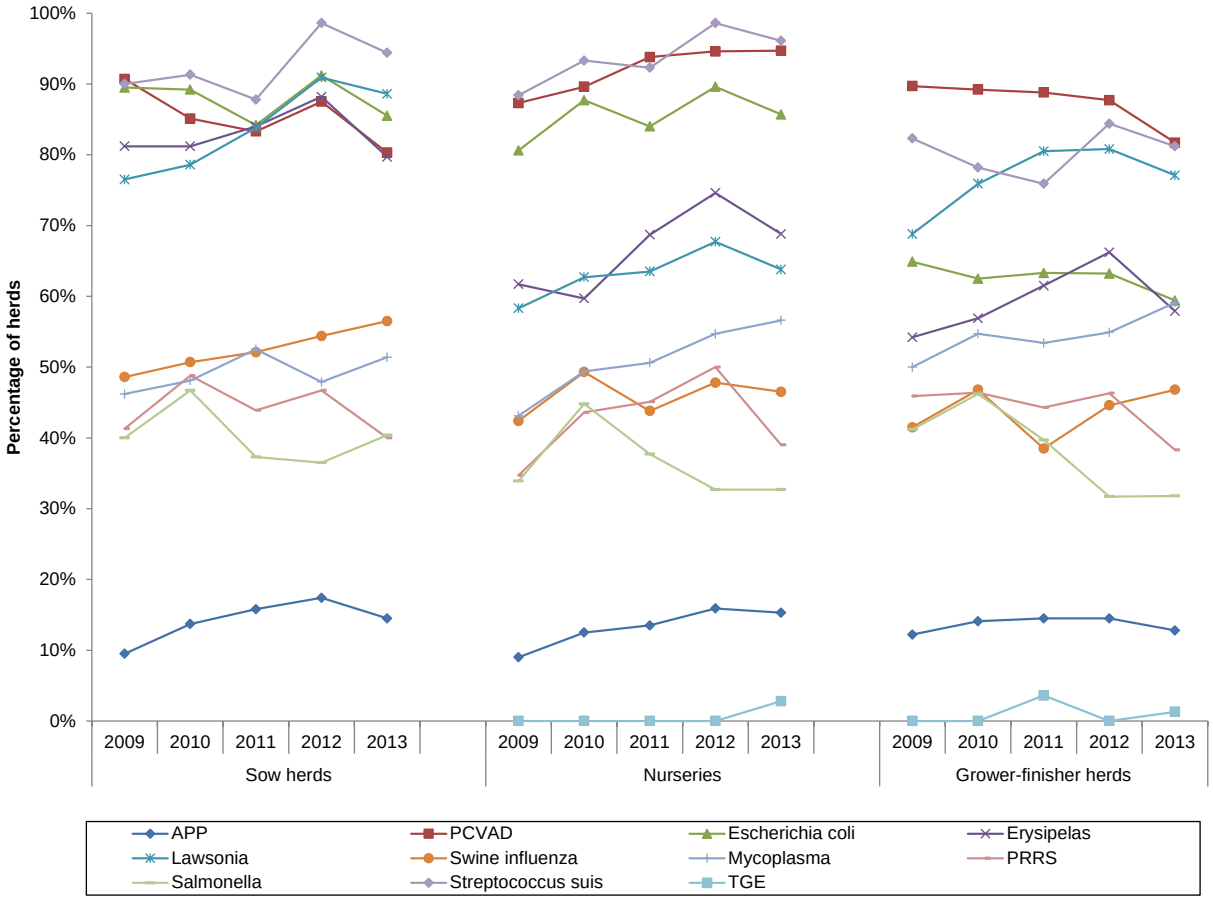
APP = *Actinobacillus pleuropneumoniae.*
PCVAD = Porcine Circovirus Associated Disease.
PRRS = Porcine Reproductive and Respiratory Syndrome.
TGE = Transmissible gastroenteritis.
For grower-finisher pigs received from more than one source, if at least one nursery was positive, the nurseries were considered positive.
Other disease reported in nursery herds included: *Actinobacillus suis*, *Hemophilus parasuis*, and rotavirus.

Figure 2.15. Reported health status of sow herds supplying pigs to grower-finisher herds, 2013



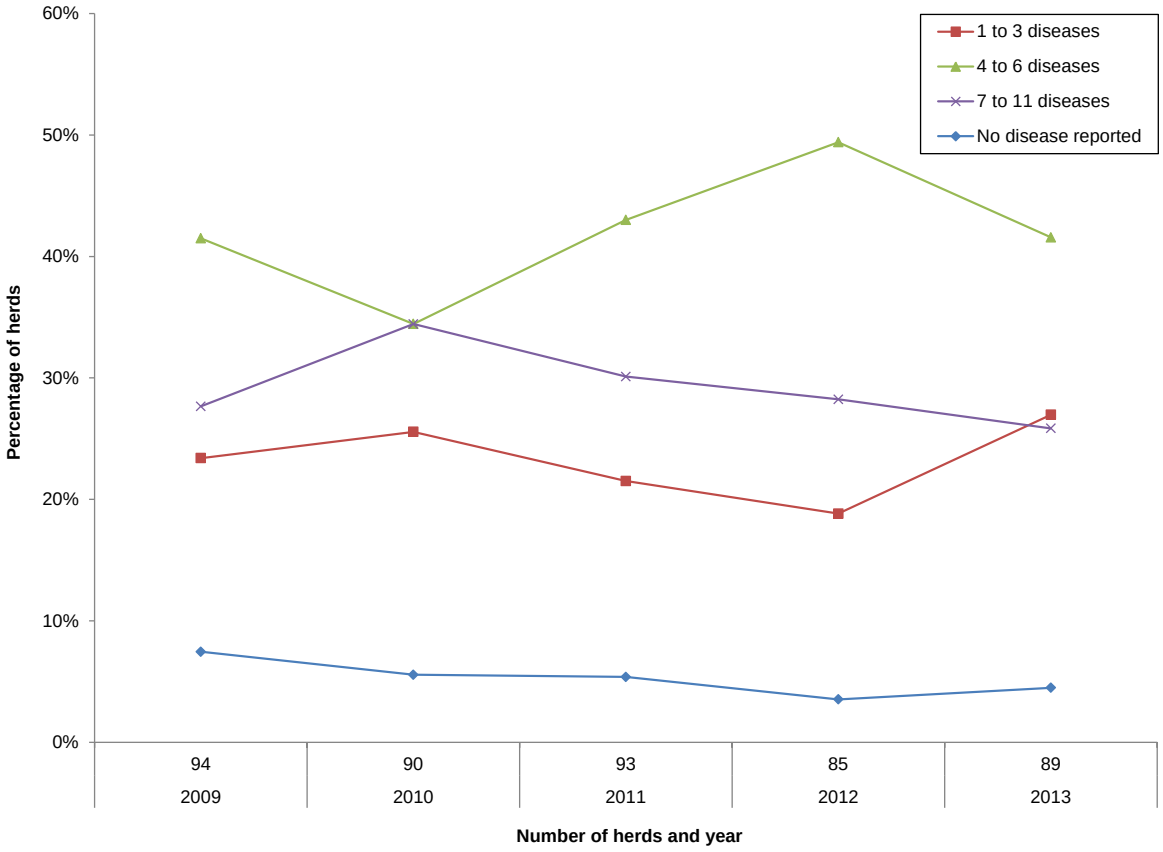
APP = *Actinobacillus pleuropneumoniae.*
PCVAD = Porcine Circovirus Associated Disease.
PRRS = Porcine Reproductive and Respiratory Syndrome.
Other disease reported in sow herds included: *Actinobacillus suis* and *Hemophilus parasuis*.
Thirteen grower-finisher herds did not know the health status of the sow herd(s) supplying pigs to their facility.
For grower-finisher pigs received from more than one source, if at least one sow herd was positive, the sow herds were categorized as positive.

Figure 2.16. Reported health status of grower-finisher herds and their associated sow herds and nurseries, 2013



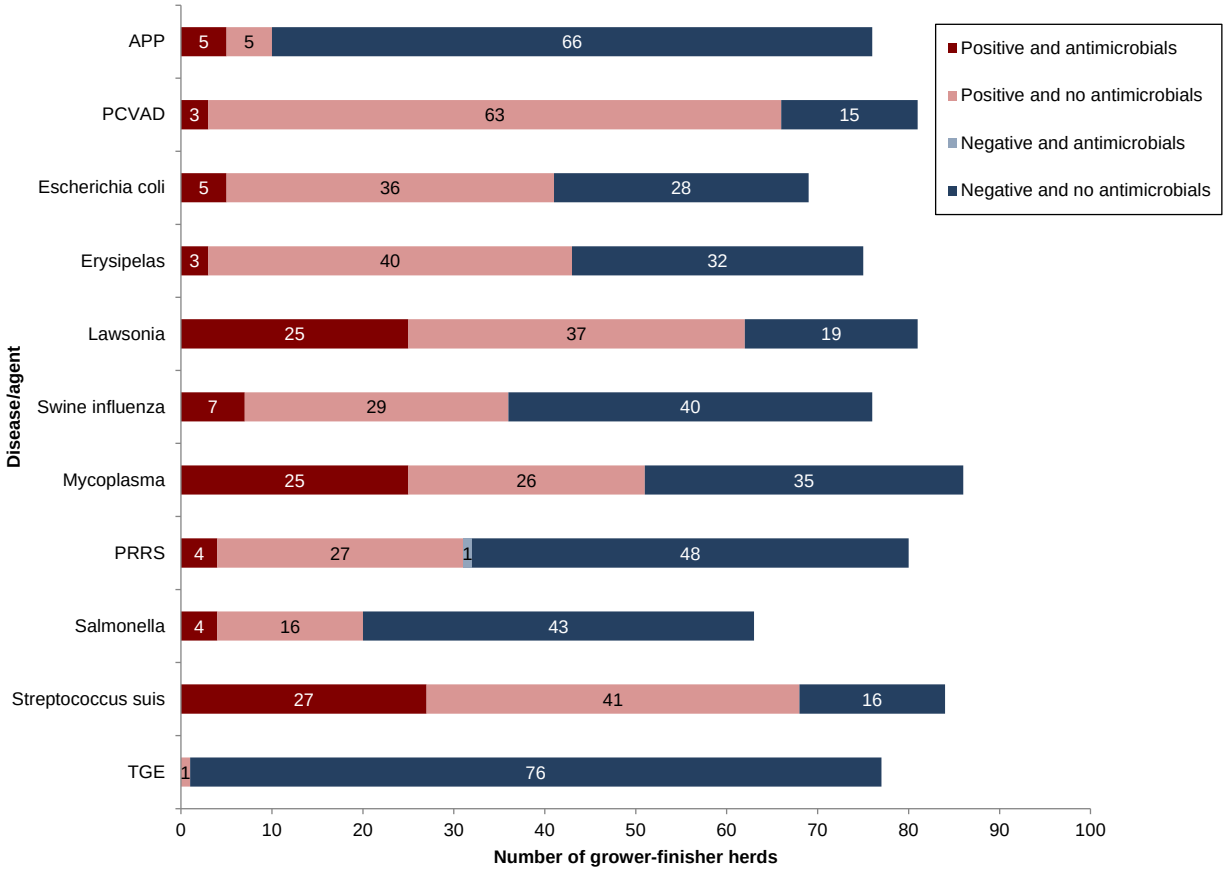
APP = *Actinobacillus pleuropneumoniae.*
PCVAD = Porcine Circovirus Associated Disease.
PRRS = Porcine Reproductive and Respiratory Syndrome.
TGE = Transmissible gastroenteritis.
TGE was not included in the sow herd survey.
For grower-finisher pigs received from more than one source, if at least one nursery was positive, the nurseries were considered positive. As well, if at least one sow herd was positive for a specific disease, the sow herds were considered positive.
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”.

Figure 2.17. Number of diseases reported on grower-finisher herds, 2013



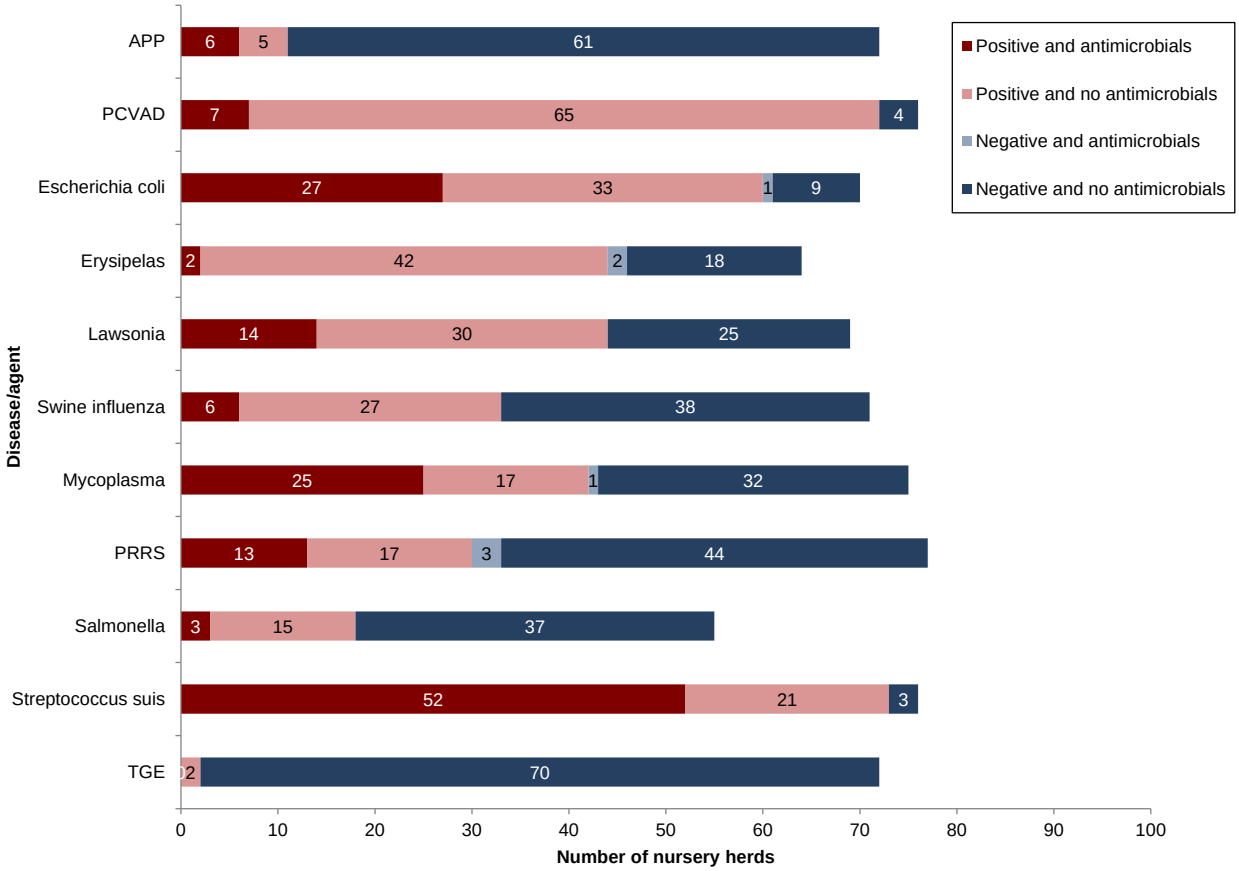
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

Figure 2.18. Reported antimicrobial use for specific diseases in grower-finisher herds, by disease status, 2013



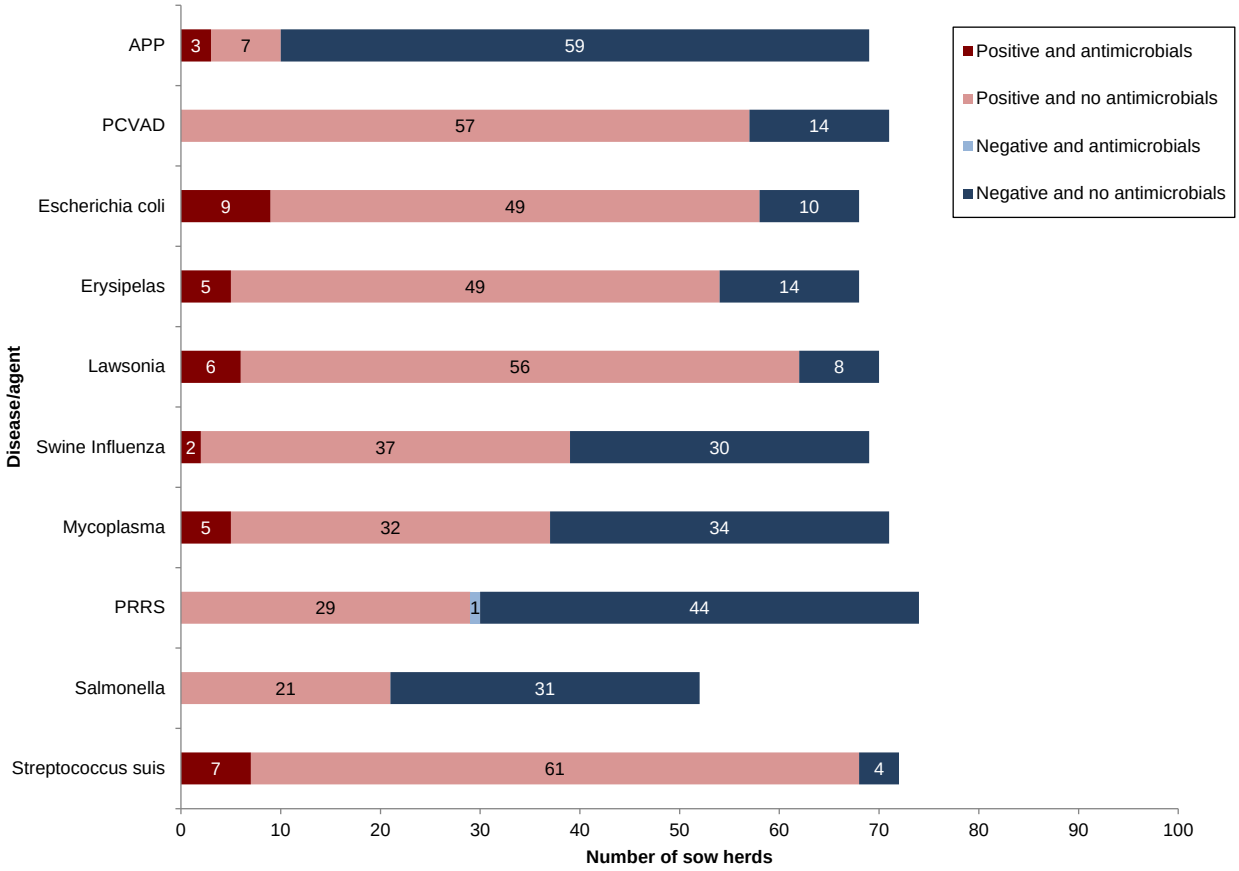
APP = *Actinobacillus pleuropneumoniae*.
PCVAD = Porcine Circovirus Associated Disease.
PRRS = Porcine Reproductive and Respiratory Syndrome.
TGE = Transmissible gastroenteritis.
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was “Confirmed negative” or "Likely negative".
Positive and antimicrobials = Number of herds positive for a disease that used antimicrobials to control that disease.
Positive and no antimicrobials = Number of herds positive for a disease that did not use antimicrobials to control that Disease.
Negative and antimicrobials = Number of herds negative for a disease that used antimicrobials to control that disease.
Negative and no antimicrobials = Number of herds negative for a disease that did not use antimicrobials to control that disease.
Not all questionnaires were complete for all diseases listed.

Figure 2.19. Reported antimicrobial use for specific diseases in nurseries supplying grower-finisher herds, by disease status, 2013



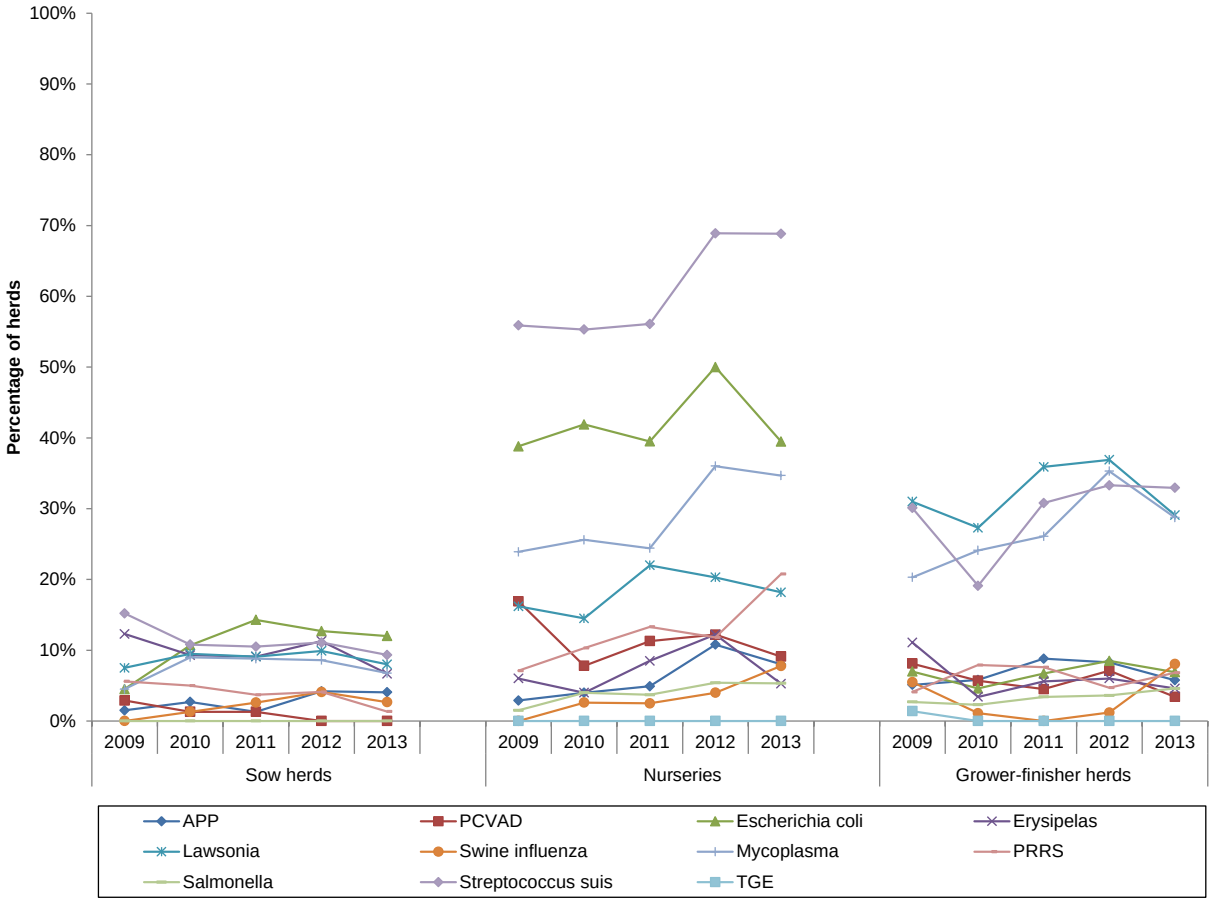
APP = *Actinobacillus pleuropneumoniae.*
PCVAD = Porcine Circovirus Associated Disease.
PRRS = Porcine Reproductive and Respiratory Syndrome.
TGE = Transmissible gastroenteritis.
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was “Confirmed negative” or “Likely negative”.
Positive and antimicrobials = Number of herds positive for a disease that used antimicrobials to control that disease.
Positive and no antimicrobials = Number of herds positive for a disease that did not use antimicrobials to control that Disease.
Negative and antimicrobials = Number of herds negative for a disease that used antimicrobials to control that disease.
Negative and no antimicrobials = Number of herds negative for a disease that did not use antimicrobials to control that disease.
Not all questionnaires were complete for all diseases listed.

Figure 2.20. Reported antimicrobial use for specific diseases in sow herds supplying grower-finisher herds, by disease status, 2013



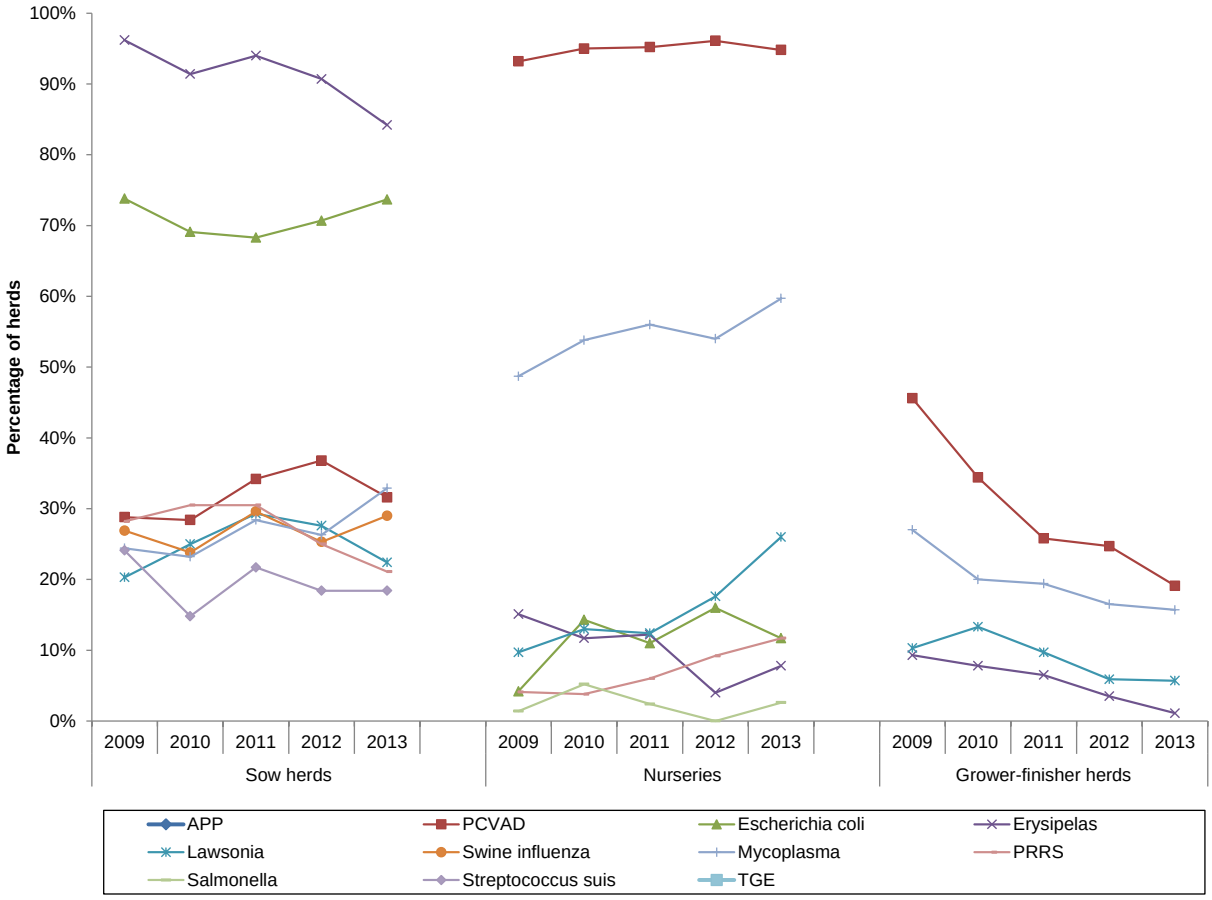
APP = *Actinobacillus pleuropneumoniae.*
PCVAD = Porcine Circovirus Associated Disease.
PRRS = Porcine Reproductive and Respiratory Syndrome.
Not all questionnaires were complete for all diseases listed
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".
Positive and antimicrobials = Number of herds positive for a disease that used antimicrobials to control that disease.
Positive and no antimicrobials = Number of herds positive for a disease that did not use antimicrobials to control that Disease.
Negative and antimicrobials = Number of herds negative for a disease that used antimicrobials to control that disease.
Negative and no antimicrobials = Number of herds negative for a disease that did not use antimicrobials to control that disease.
Not all questionnaires were complete for all diseases listed.

Figure 2.21. Reported antimicrobial use for specific diseases in grower-finisher herds and their associated sow herds and nurseries, 2013



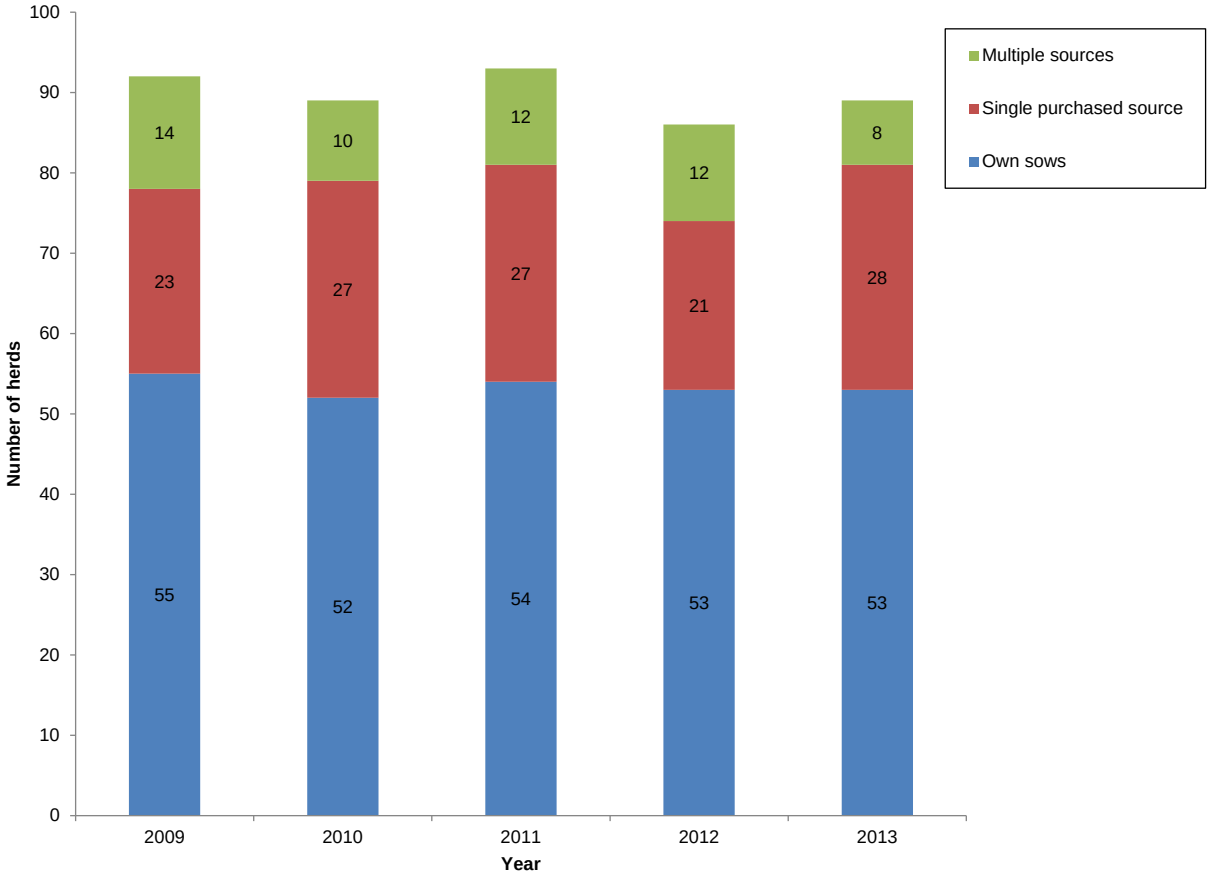
APP = *Actinobacillus pleuropneumoniae.*
PCVAD = Porcine Circovirus Associated Disease.
PRRS = Porcine Reproductive and Respiratory Syndrome.
TGE = Transmissible gastroenteritis.
Health status was considered to be positive if the questionnaire response was "Confirmed positive" or "Likely positive". Health status was considered to be negative if the questionnaire response was "Confirmed negative" or "Likely negative".

Figure 2.22. Reported vaccination status of grower-finisher herds and their associated sow herds and nurseries, 2013



APP = *Actinobacillus pleuropneumoniae*.
PCVAD = Porcine Circovirus Associated Disease.
PRRS = Porcine Reproductive and Respiratory Syndrome.
TGE = Transmissible gastroenteritis.
TGE was not included in the sow herd survey.
Diseases where less than 5% of herds vaccinated for all years (2009–2013) were not included in the graph. This included, for sow herds APP and *Salmonella*; for nurseries APP, Swine influenza, *Streptococcus suis*, TGE; for grower-finisher herds APP, *E. coli*, Swine influenza, PRRS, *Salmonella*, *Streptococcus suis*, and TGE.

Figure 2.23. Source of pigs for grower-finisher herds, 2013



Herds that had their own sows and also purchased pigs from a single source/ multiple sources were classified as multiple source herds.

Figure 2.24. Ownership and location of sow herds supplying grower-finisher herds, 2013

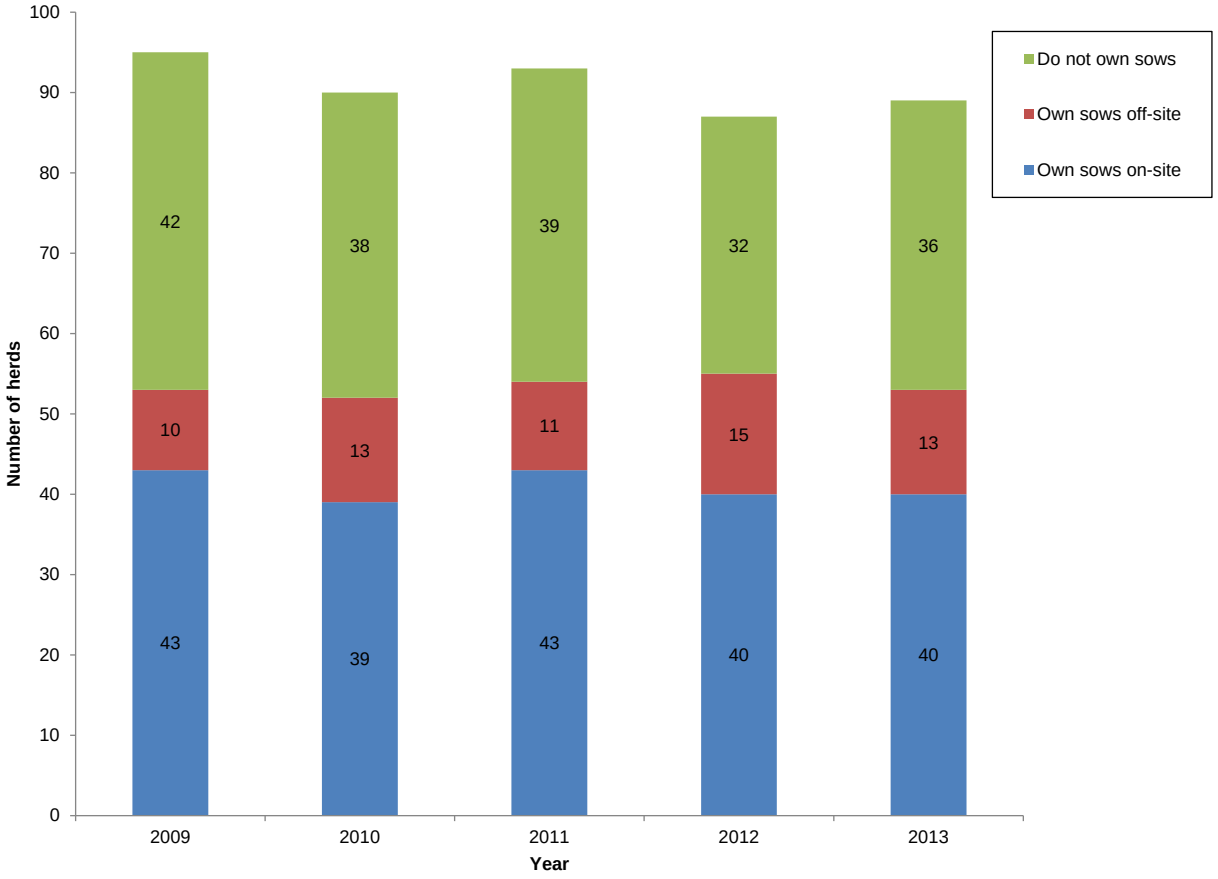
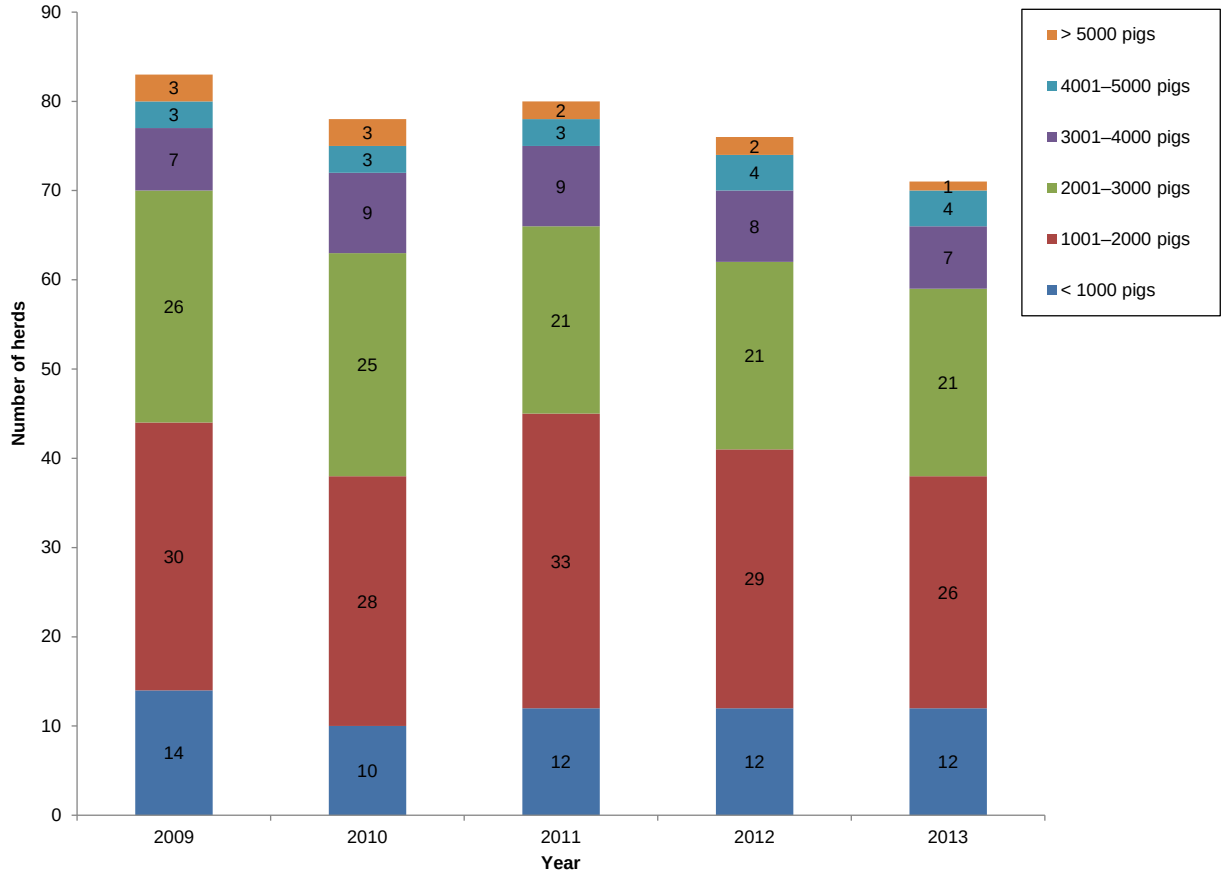


Figure 2.25. Maximum grower-finisher barn size of grower-finisher herds, 2013



Maximum grower-finisher barn size was determined based on the maximum reported grower-finisher inventory for a barn over the entire period of the herd's participation in the CIPARS program. Herds that only reported inventory by room were excluded. Participating herds may have additional barns that were not sampled for the CIPARS program therefore this barn size is not necessarily equivalent to grower-finisher herd size.

Figure 2.26. Number of pig farms within 2 km of grower-finisher herds, 2013

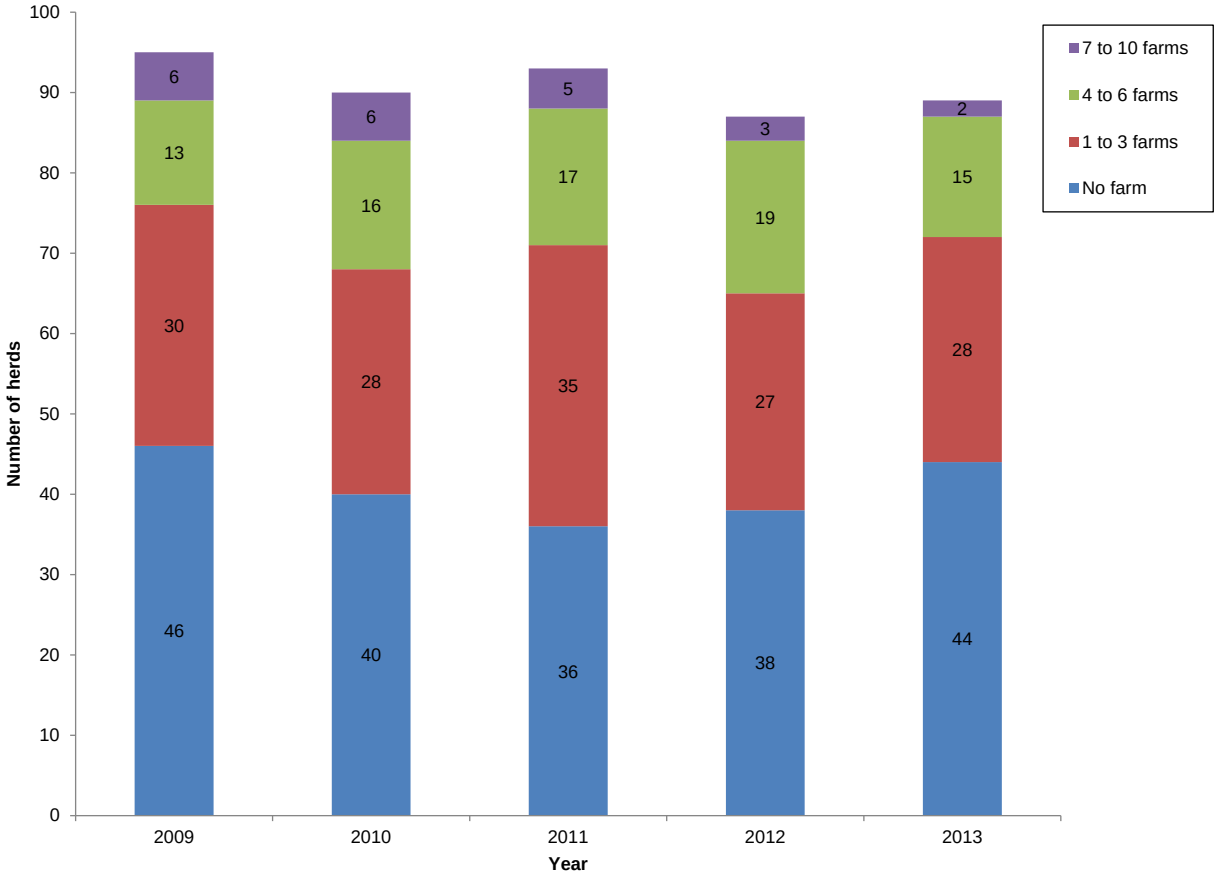
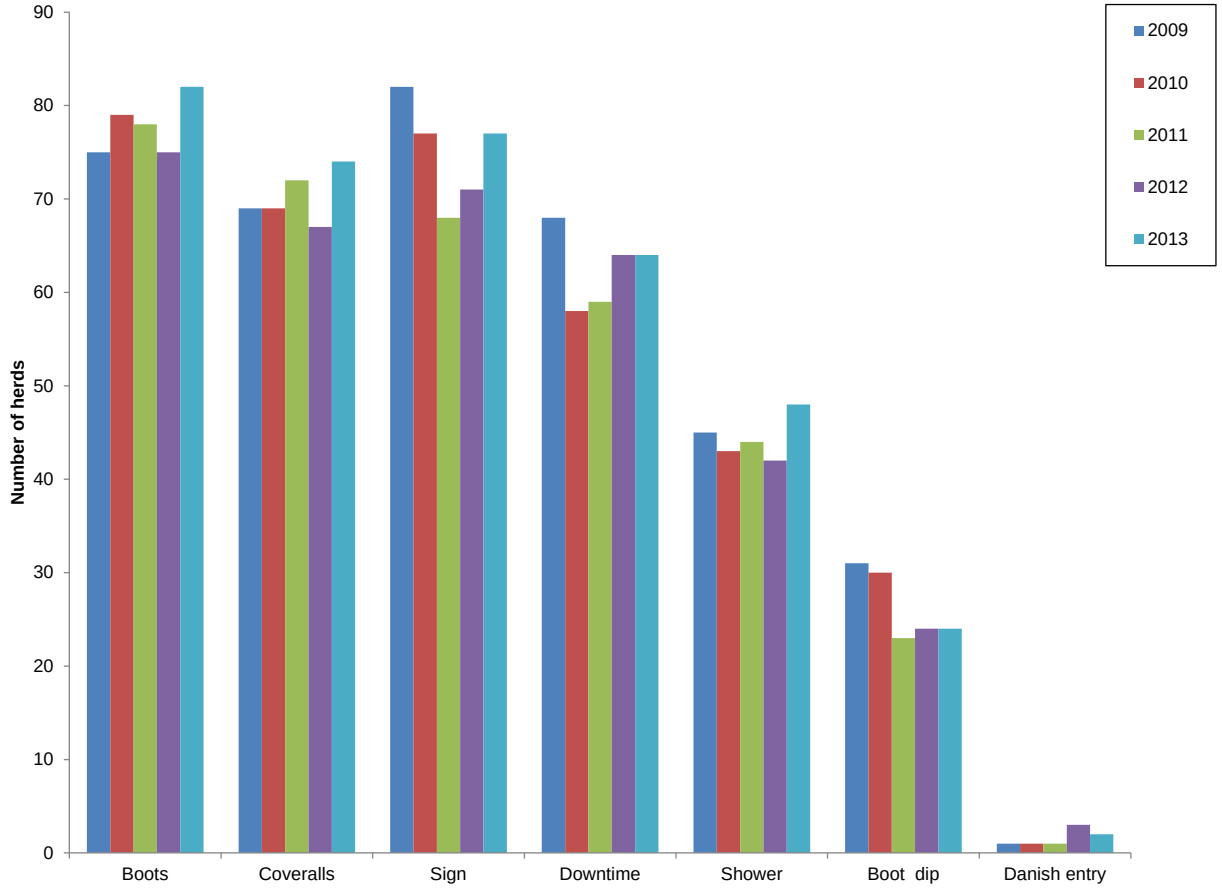
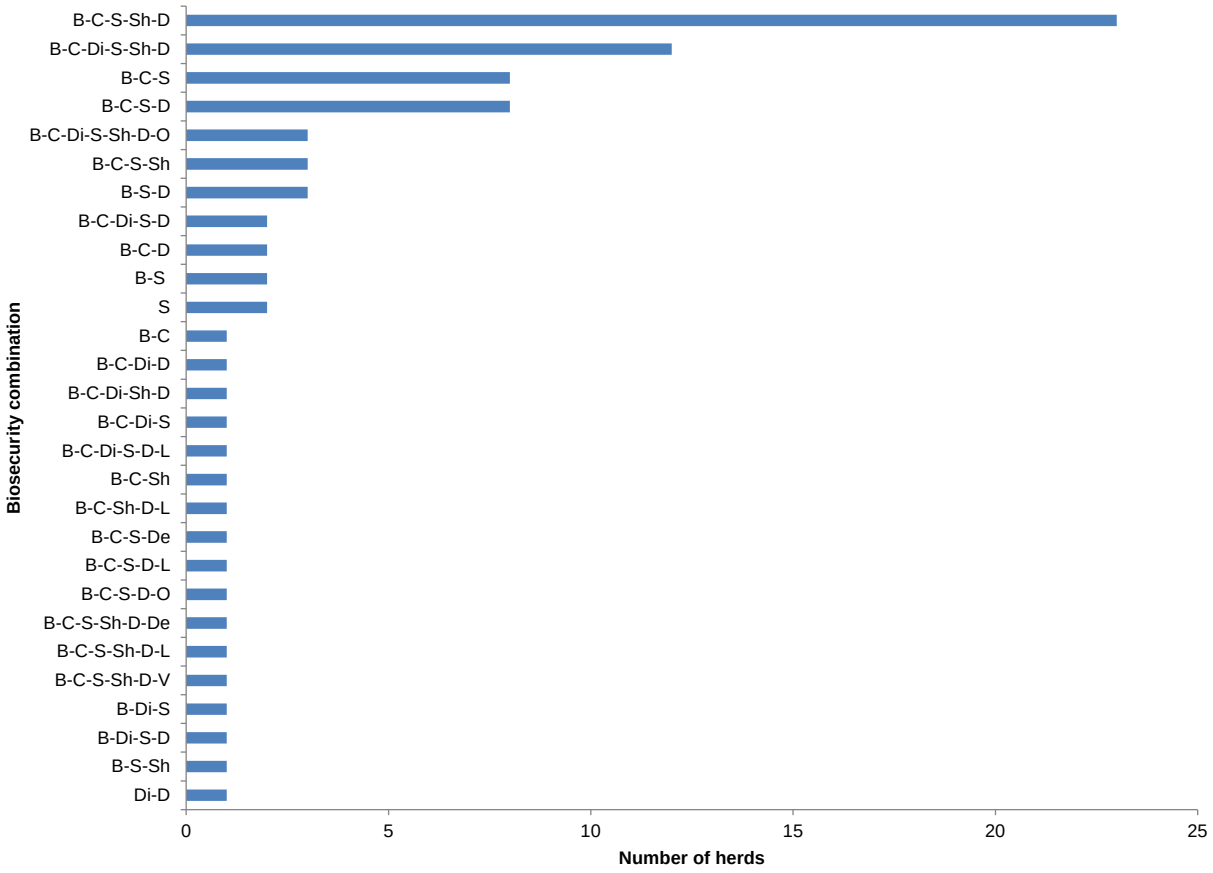


Figure 2.27. Biosecurity measures utilized in grower-finisher herds, 2013



The "Danish entry" was not specifically listed in the questionnaire but was indicated in the "Other" category, therefore the number of herds reporting this biosecurity measure may be an under-representation. Additional biosecurity measures specified in the "Other" category included: composter, dedicated transport and feed deliveries, fence/gate, handwash, isolated geographical location, locked doors, rodent control, restricting visitors, and separate gilt facility.

Figure 2.28. Combinations of biosecurity measures utilized in grower-finisher herds (n = 85), 2013



B = Boots provided by farm
C = Coveralls provided by farm
D = Downtime required after visiting another pig farm
De = Danish entry system
Di = Boot dip
L = Locked doors
O = Other
S = Sign
Sh = Shower in facility
V = Restricting visitors
The ''Danish entry'', ''Locked doors'', and ''Restricting visitors'' were not included in the questionnaire but were indicated under additional biosecurity measures in the ''Other'' category, therefore the number of herds reporting this biosecurity measure may be an under-representation. Four herds did not report their biosecurity measures.

3. QUANTITIES OF ANTIMICROBIALS DISTRIBUTED FOR SALE FOR USE IN ANIMALS

KEY FINDINGS

- In 2013, 1.5 million kilograms of antimicrobials were distributed for sale for use in animals in Canada by the Canadian Animal Health Institute (CAHI) member companies; a decrease of 16% relative to the 2006 total and a decrease of 9% relative to the 2012 total (Table 3.1). Of the 1.5 million kg, 24% were in Category IV; considered of low importance in human medicine (ionophores and chemical coccidiostats.
- Similar to other years, the predominant classes of antimicrobials distributed for sale in 2013 were the tetracyclines, ionophores, β-lactams, "other antimicrobials", and the macrolides (based on kg active ingredient; Figure 3.1).
- The quantity of fluoroquinolones distributed for use in animals in 2013 decreased by 21% relative to the 2006 total and increased by 15% relative to the 2012 total (based on kg active ingredient; Table 3.1).
- There were provincial differences between the quantities of antimicrobials distributed for sale (Table 3.2, Figure 3.2, and Figure 3.3) and differences within provinces in the quantities distributed between years. These differences could be related to different numbers and types of animals in each province, differences in disease pressure, or differences in antimicrobial use practices. The quantities reported per province reflect the quantities distributed to veterinary clinics, feed mills, and over-the-counter outlets by CAHI member companies. There may be subsequent re-distribution of antimicrobials across provincial borders after this point.
- Provinces with greater than 10% decline in reported quantity of antimicrobials distributed between 2012 and 2013 (as compared to the 2012 total) were Alberta, Ontario, and Nova Scotia. Québec was the only province with greater than 10% increase in quantity of antimicrobial distributed between 2012 and 2013.
- In 2013, the quantity of antimicrobials distributed for use in companion animals represented 0.2% of the total antimicrobials distributed for sale (ionophores and chemical coccidiostats included) (Table 3.3).

- Antimicrobials distributed for sale for use in companion animal were mostly β-lactams, sulfonamides including trimethoprim, and cephalosporins, while production animals were mostly tetracyclines, ionophores, and β-lactams (Figure 3.4 and Figure 3.5).
- In terms of the Canadian animal population, the animal biomass in Canada has decreased over time from the highest point in 2006. Since 2006, there has been a 16% decline in the biomass (population correction unit=PCU) and a 1% decline since 2012 (Figure 3.6).
- Comparing the 2013 animal biomass to 2006, the respective declines in the PCU were as follows: cattle 20%, swine 15%, poultry 5%, rabbits 3%, and sheep and goats 1%.
- Including data on companion animals in the numerator, the mg/PCU in 2013 increased by 2% since 2006 (in comparison to the 2006 total) and increased by 1% in comparison to the 2012 total (Figure 3.7).
- New macrolides were registered in 2012 and 2013 in Canada and the volumes for the new product have been reported since 2012.
- For international comparison, the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC), at the time of writing, had data available for 26 member countries for 2013. Comparing the most recent data (Canada 2013, ESVAC 2013), Canada ranked as 4th highest for PCU (with first rank #1 being the country with the highest animal biomass); only lower than Germany, France, and Spain. When compared to the countries participating in the ESVAC network, for the mg/PCU, Canada was 21 out of 27 countries (Figure 3.8), when ranked from smallest to highest mg/PCU. Canada's position would be further to the left on the figure (higher mg adjusted by populations and weights) if we could account for the currently unrecorded imports of antimicrobials which fall under own-use importation and imports of active pharmaceutical ingredients intended for further compounding.
- Canadian standard weights and provincial-level animal numbers are currently being further developed.

NATIONAL-LEVEL ANTIMICROBIAL DISTRIBUTION DATA

Table 3.1. Quantity of antimicrobials distributed in Canada for sale for use in animals, 2006–2013

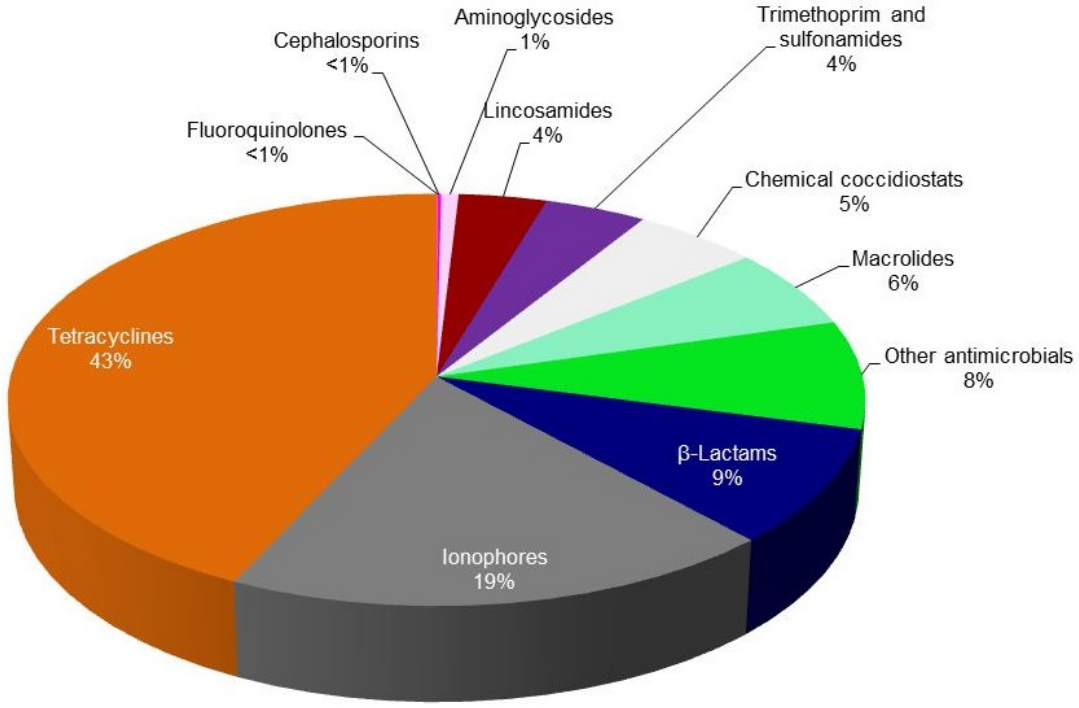
Antimicrobial class aggregation	Quantity of active ingredient (kg)								Change (%) from 2006 to 2013	Change (%) from 2012 to 2013
	2006	2007	2008	2009	2010	2011	2012	2013		
Aminoglycosides	5,122	4,302							NA	NA
			5,817	4,652	3,961				NA	NA
						12,250	10,372	10,785	NA	4%
Amphenicols	NA	NA	3,242	4,001	4,391	NA	NA	NA	NA	NA
β-Lactams	58,538	52,594							NA	NA
			109,153	118,109	201,934				NA	NA
						147,908			NA	NA
							136,611		NA	NA
								134,838	NA	NA
Cephalosporins	702	850	NA	NA	NA				NA	NA
						6,725	6,388	2,403	NA	-62%
Fluoroquinolones	591	443	411	377	381	519	406	469	-21%	15%
Ionophores, chemical anticoccidials, and arsenicals[a]	455,753	445,952							NA	NA
Ionophores, chemical anticoccidials, arsenicals, and nitroimidazoles[a]			472,384	491,152	490,355				NA	NA
Chemical coccidiostats[a]						22,372			NA	NA
							18,471		NA	NA
								78,493	NA	NA
Ionophore coccidiostats[a]						433,897			NA	NA
							473,595		NA	NA
								278,297	NA	NA
Lincosamides	67,825	55,872	41,222	44,137	46,373	43,261	51,027	54,784	-19%	7%
Macrolides and pleuromutilins	136,497	118,725							NA	NA
Macrolides, pleuromutilins, and bacitracins	NA	NA	210,869	204,169	170,154				NA	NA
Macrolides	NA	NA	NA	NA	NA	108,862	98,622	93,870	NA	0
Other antimicrobials	143,029	146,880							NA	NA
			32,706	21,339	26,757				NA	NA
						130,911			NA	NA
							129,614		NA	NA
								125,511	NA	NA
Tetracyclines	847,281	753,168	680,601	686,832	535,142	600,930	635,435	635,675	-25%	0%
Trimethoprim and sulfonamides	50,789	38,961	59,166	57,596	48,221	70,465	58,716		NA	NA
								63,367	NA	NA
Total	**1,766,126**	**1,617,748**	**1,615,571**	**1,632,365**	**1,527,669**	**1,578,100**	**1,619,257**	**1,478,492**	**-16%**	**-9%**

See corresponding footnotes on next page.

Table 3.1. Quantity of antimicrobials distributed in Canada for sale for use in animals, 2006–2013 (cont'd)

Values do not include own use imports or active pharmaceutical ingredients used in compounding.
NA=Not available or no longer applicable.
CAHI provides the information according to a "3 company accounting rule" established by CAHI to comply with the European Union and the United States' anti-competition regulations. CAHI added in some cases a "90% rule" to be sure not to infringe the regulations in the United States. These accounting rules can result in changes to the categorization of specific antimicrobials over time; hence within an antimicrobial category, columns with different colours should not be compared.
Changes in percentage over time from 2006 to 2013 are relative to the quantities reported in 2006. Changes in percentage over time from 2011 to 2013 are relative to the quantities reported in 2011.
A new macrolide molecule was registered in Canada in 2012 and the volumes for the new product are reported in both 2012 and 2013.
"Other antimicrobials" for 2013 included: bacitracin, bambermycin, chloramphenicol, clavulanic acid, florfenicol, nitrofurantoin, nitrofurazone, novobiocin, ormethoprim, polymyxin, tiamulin, and virginiamycin.
[a] These antimicrobial classes are considered of low importance to human medicine (Category IV) according to Veterinary Drugs. Directorate.

Figure 3.1. Percentages of the quantities (kg of active ingredient) of antimicrobials distributed in Canada for sale for use in animals, 2013



Values do not include own use imports or active pharmaceutical ingredients used in compounding.
"Other antimicrobials" for 2013 included: bacitracin, bambermycin, chloramphenicol, clavulanic acid, florfenicol, nitrofurantoin, nitrofurazone, novobiocin, ormethoprim, polymyxin, tiamulin, and virginiamycin.

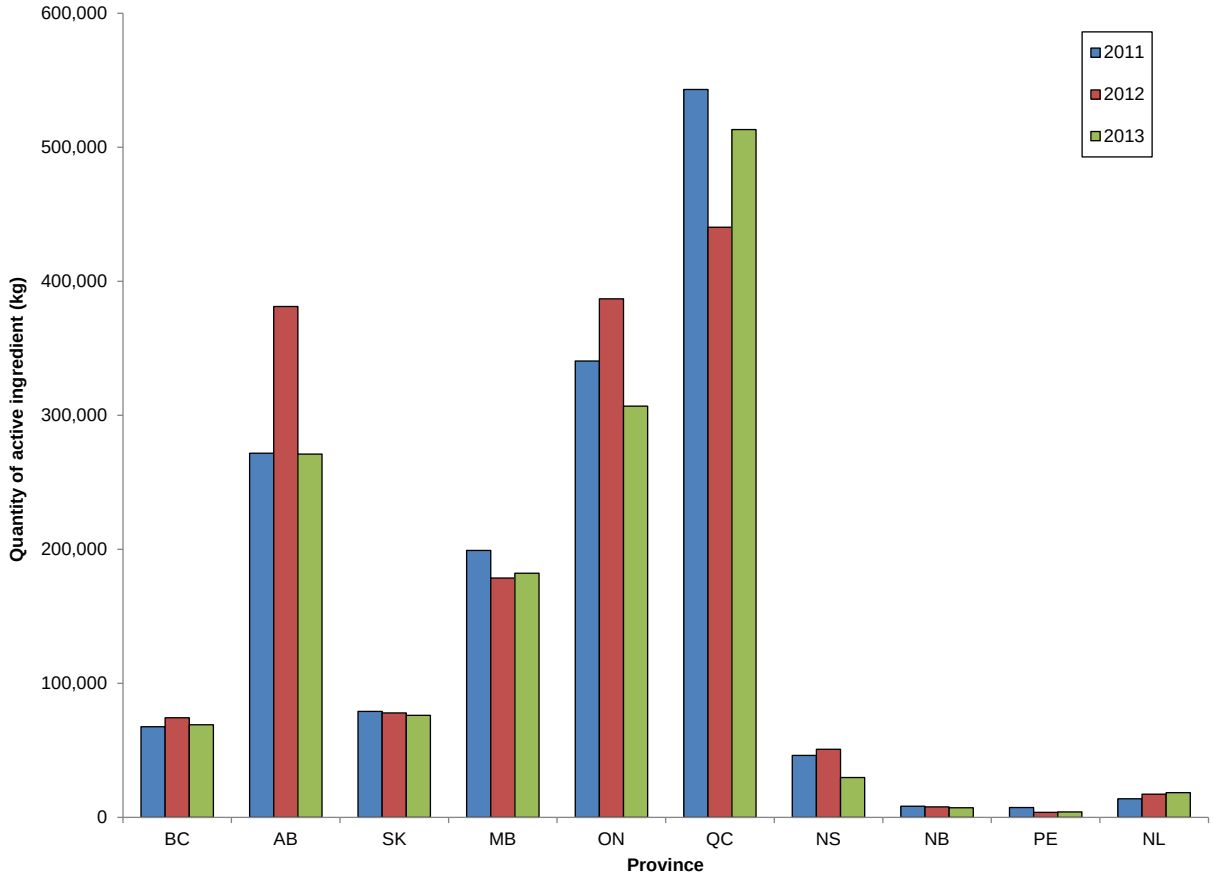
PROVINCIAL-LEVEL ANTIMICROBIAL DISTRIBUTION DATA

Table 3.2. Quantity of antimicrobials (kg of active ingredient) distributed for sale for use in animals, by province, 2011–2013

Year	Province	Aminoglycosides	B-Lactams and penicillin	Cephalosporins	Fluoroquinolones	Chemical coccidiostats	Ionophores	Lincosamides	Macrolides	Other antimicrobials	Tetracyclines	Trimethoprim and sulfonamides	Total
2013	BC	628	10,669	181	49	12,619	17,890	90	928	11,267	12,474	2,395	69,189
	AB	664	19,613	437	102	2,652	79,208	7,596	12,803	17,160	118,675	12,195	271,106
	SK	311	6,707	101	6	454	24,717	3,224	5,592	6,030	24,787	4,204	76,132
	MB	553	16,184	206	16	889	29,728	13,490	10,955	9,494	91,201	9,575	182,292
	ON	3,007	48,319	596	192	9,832	47,434	14,289	13,053	33,254	116,662	20,248	306,886
	QC	3,997	29,926	792	91	17,187	103,767	15,898	50,121	29,562	248,315	13,610	513,266
	NS	793	1,367	35	7	1,201	4,681	64	410	8,784	11,679	711	29,732
	NB	125	1,147	28	3	89	919	85	4	494	4,035	250	7,180
	PE	50	501	16	1	1	0	1	4	604	2,881	107	4,164
	NL	658	404	11	2	213	3,308	47	0	8,863	4,967	72	18,544
Total		**10,785**	**134,838**	**2,403**	**469**	**45,138**	**311,652**	**54,784**	**93,870**	**125,511**	**635,675**	**63,367**	**1,478,492**
2012	BC	598	9,966	658	42	1,017	26,973	81	454	17,255	15,233	2,100	74,376
	AB	643	20,939	1,102	88	1,745	181,282	6,921	30,355	14,592	113,282	10,242	381,193
	SK	294	5,449	229	6	300	27,290	4,581	2,939	5,060	28,622	3,203	77,971
	MB	674	16,057	404	21	1,001	34,213	13,175	11,434	9,285	84,755	7,557	178,577
	ON	3,012	54,031	2,248	172	5,436	113,602	11,796	23,651	37,735	114,729	20,505	386,917
	QC	4,175	26,322	1,376	65	8,430	78,308	14,077	29,163	27,747	236,532	14,168	440,364
	NS	520	1,624	199	7	489	7,658	48	590	7,572	31,534	556	50,797
	NB	116	1,332	99	4	52	720	343	11	1,060	4,018	203	7,959
	PE	46	499	34	1	2	0	3	7	690	2,382	117	3,781
	NL	294	391	40	2	0	3,549	2	18	8,617	4,347	62	17,322
Total		**10,372**	**136,611**	**6,388**	**406**	**18,471**	**473,595**	**51,027**	**98,622**	**129,614**	**635,435**	**58,716**	**1,619,257**
2011	BC	775	11,690	583	50	1,190	24,089	113	827	15,186	10,371	2,881	67,755
	AB	930	22,497	1,190	137	2,338	71,682	6,711	41,567	13,015	97,868	13,853	271,788
	SK	206	6,112	308	15	1,294	22,369	4,821	5,187	4,600	28,401	5,786	79,099
	MB	1,117	17,896	501	22	928	57,400	9,849	14,326	7,119	80,852	9,156	199,166
	ON	3,448	54,305	1,938	206	4,433	89,954	8,410	13,326	39,170	105,905	19,388	340,483
	QC	4,443	30,277	1,881	73	9,330	156,118	12,952	32,275	34,709	242,951	18,126	543,135
	NS	614	1,919	140	9	2,742	8,577	48	615	8,875	22,069	684	46,292
	NB	156	2,244	98	4	117	666	351	566	945	2,915	267	8,329
	PE	60	531	40	1	0	1,271	0	153	586	4,626	197	7,465
	NL	493	382	37	2	0	1,206	1	16	6,694	4,960	116	13,907
Total		**12,242**	**147,853**	**6,716**	**519**	**22,372**	**433,332**	**43,256**	**108,858**	**130,899**	**600,918**	**70,454**	**1,577,419**

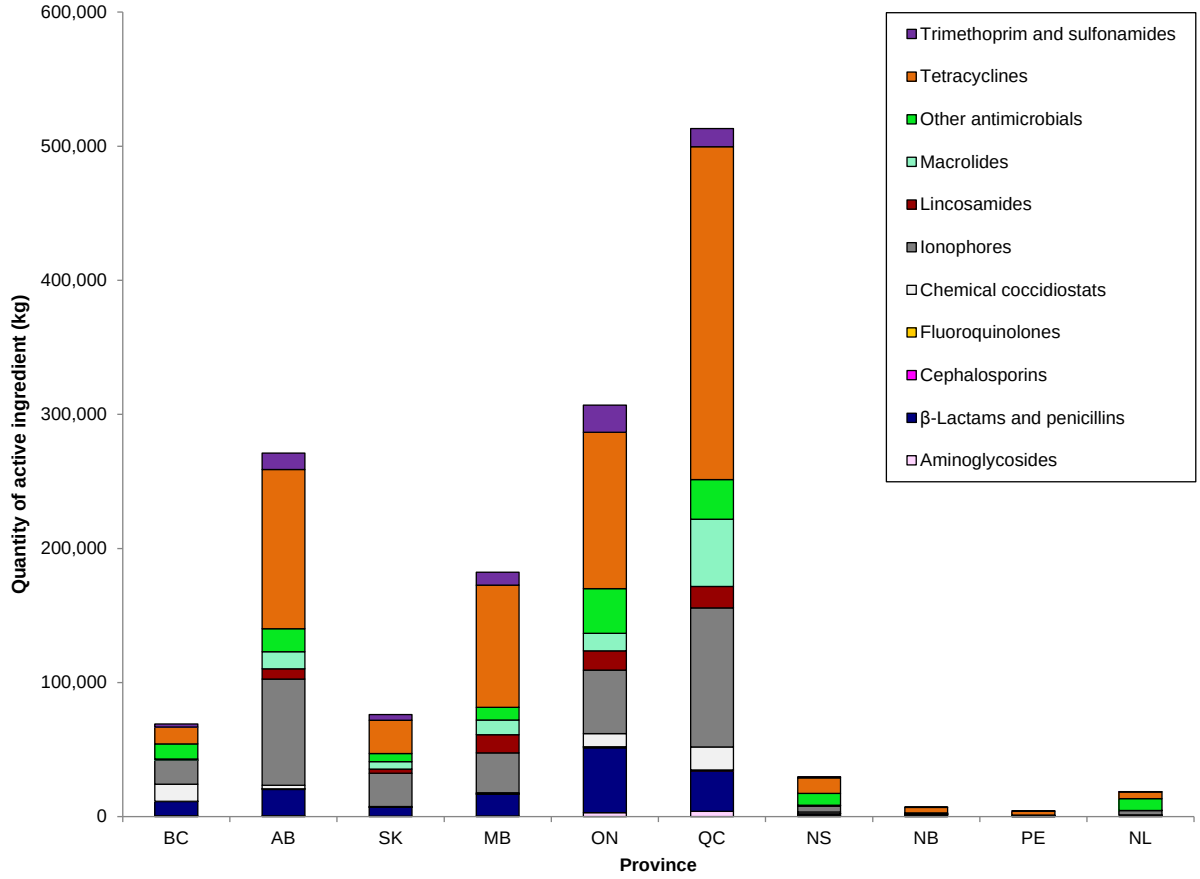
Values do not include own use imports or active pharmaceutical ingredients used in compounding.
There may be subsequent distribution of antimicrobials across provincial borders after being distributed to the veterinary clinics.
"Other antimicrobials" for 2013 included: bacitracin, bambermycin, chloramphenicol, clavulanic acid, florfenicol, nitrofurantoin, nitrofurazone, novobiocin, ormethoprim, polymixin, tiamulin, and virginiamycin.
British Columbia (BC), Alberta (AB), Saskatchewan (SK), Manitoba (MB), Ontario (ON), Québec (QC), Nova Scotia (NS), New Brunswick (NB), Prince Edward Island (PE), and Newfoundland and Labrador (NL).

Figure 3.2. Quantity of antimicrobials (kg of active ingredient) distributed for sale for use in animals, by province, 2011–2013



Values do not include own use imports or active pharmaceutical ingredients used in compounding.
There may be subsequent distribution of antimicrobials across provincial borders after being distributed to the veterinary clinics.
This figure does not account for provincial differences in numbers or types of animals or disease pressures.

Figure 3.3. Quantity of antimicrobials (kg of active ingredient) distributed for use in animals by province and antimicrobial class, 2013



Values do not include own use imports or active pharmaceutical ingredients used in compounding.
There may be subsequent distribution of antimicrobials across provincial borders after being distributed to the veterinary clinics.
This figure does not account for provincial differences in numbers or types of animals.
"Other antimicrobials" for 2013 included: bacitracin, bambermycin, chloramphenicol, clavulanic acid, florfenicol, nitrofurantoin, nitrofurazone, novobiocin, ormethoprim, polymyxin, tiamulin, and virginiamycin.

DISTRIBUTION BY ANIMAL TYPE

Table 3.3. Quantity of antimicrobials (kg) distributed for sale for use in animals, by province and animal type, 2013

Animal type /province	Aminoglycosides	B-Lactams and penicillin	Cephalosporins	Fluoroquinolones	Chemical coccidiostats	Ionophores	Lincosamides	Macrolides	Other antimicrobials	Tetracyclines	Trimethoprim and sulfonamides	Total
Production animal												
BC	628	10,539	168	34	12,619	17,890	89	928	11,259	12,474	2,341	68,970
AB	664	19,376	406	71	2,652	79,208	7,578	12,803	17,147	118,675	11,919	270,500
SK	311	6,625	94	4	454	24,717	3,216	5,592	6,025	24,787	4,109	75,935
MB	553	15,988	192	11	889	29,728	13,458	10,955	9,487	91,201	9,359	181,821
ON	3,006	47,734	554	134	9,832	47,434	14,255	13,053	33,229	116,662	19,790	305,683
QC	3,996	29,563	736	63	17,187	103,767	15,861	50,121	29,540	248,315	13,302	512,452
NS	793	1,350	32	5	1,201	4,681	64	410	8,777	11,679	695	29,688
NB	125	1,134	26	2	89	919	85	4	494	4,035	244	7,156
PE	50	494	15	1	1	0	1	4	604	2,881	105	4,154
NL	658	399	10	1	213	3,308	47	0	8,856	4,967	70	18,529
Total	**10,783**	**133,203**	**2,234**	**326**	**45,138**	**311,652**	**54,654**	**93,870**	**125,420**	**635,675**	**61,934**	**1,474,887**
Companion animal												
BC	0	129	13	15	0	0	0	0	8	0	54	220
AB	0	238	31	31	0	0	18	0	13	0	276	606
SK	0	81	7	2	0	0	8	0	4	0	95	197
MB	0	196	14	5	0	0	32	0	7	0	217	471
ON	1	586	42	59	0	0	34	0	24	0	458	1,203
QC	1	363	56	28	0	0	38	0	22	0	308	814
NS	0	17	2	2	0	0	0	0	6	0	16	44
NB	0	14	2	1	0	0	0	0	0	0	6	23
PE	0	6	1	0	0	0	0	0	0	0	2	10
NL	0	5	1	1	0	0	0	0	6	0	2	15
Total	**3**	**1,634**	**169**	**144**	**0**	**0**	**130**	**0**	**92**	**0**	**1,434**	**3,605**
Total (animal types combined)												
	10,785	**134,838**	**2,403**	**469**	**45,138**	**311,652**	**54,784**	**93,870**	**125,511**	**635,675**	**63,367**	**1,478,492**

Values do not include own use imports or active pharmaceutical ingredients used in compounding.

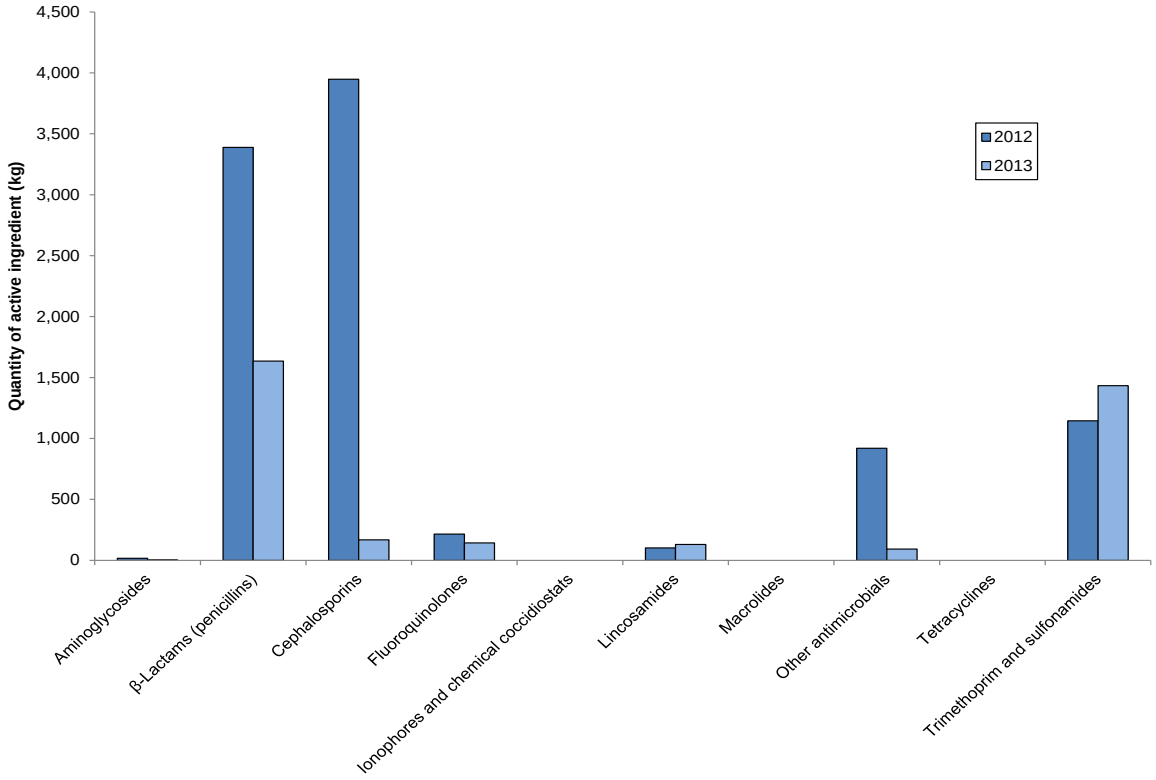
There may be subsequent distribution of antimicrobials across provincial borders after being distributed to the veterinary clinics.

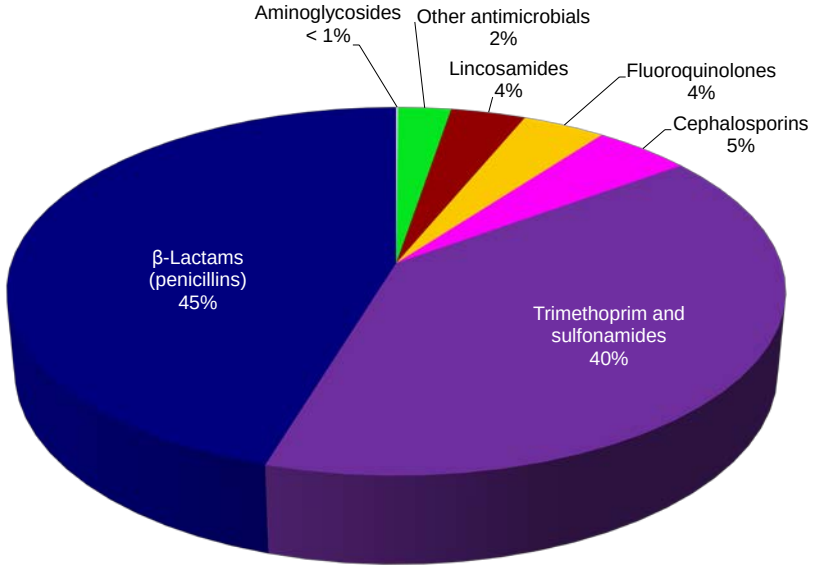
"Other antimicrobials" for 2013 included: bacitracin, bambermycin, chloramphenicol, clavulanic acid, florfenicol, nitrofurantoin, nitrofurazone, novobiocin, ormethoprim, polymyxin, tiamulin, and virginiamycin.

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

British Columbia (BC), Alberta (AB), Saskatchewan (SA), Manitoba (MB), Ontario (ON), Québec (QC), Nova Scotia (NS), New Brunswick (NB), Prince Edward Island (PE), and Newfoundland and Labrador (NL).

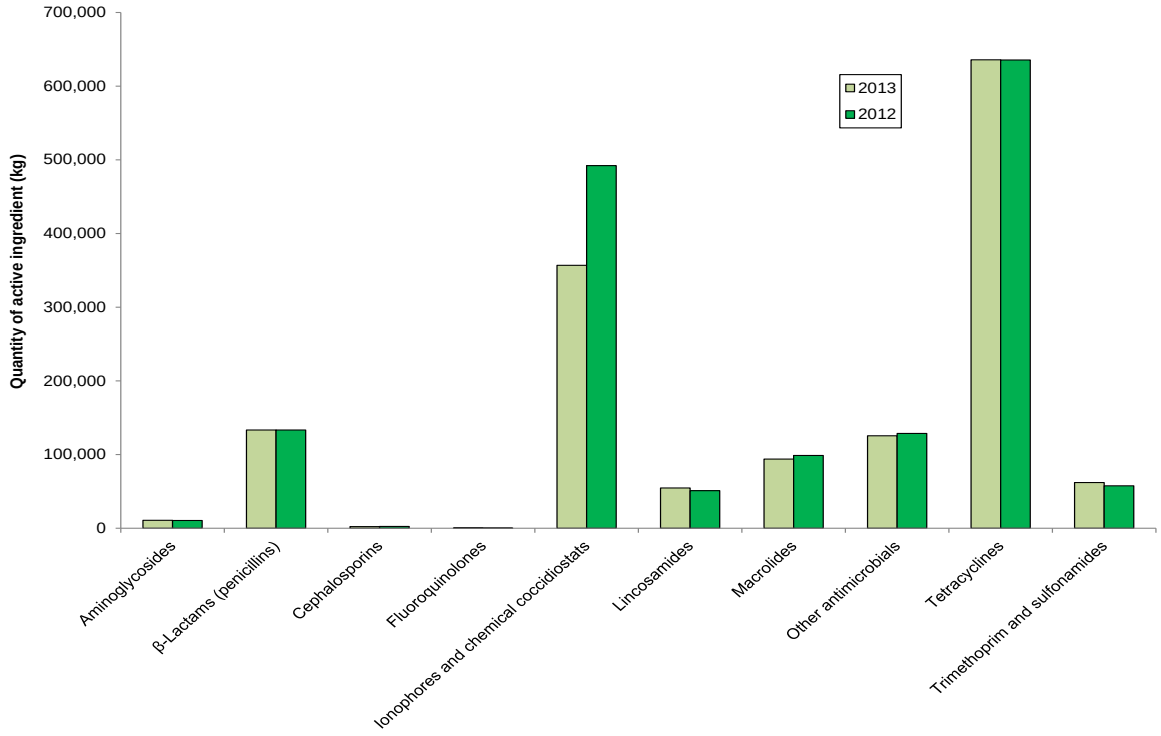
Figure 3.4. Quantity of antimicrobials (kg of active ingredient) distributed for use in companion animals (a) over time and (b) 2013

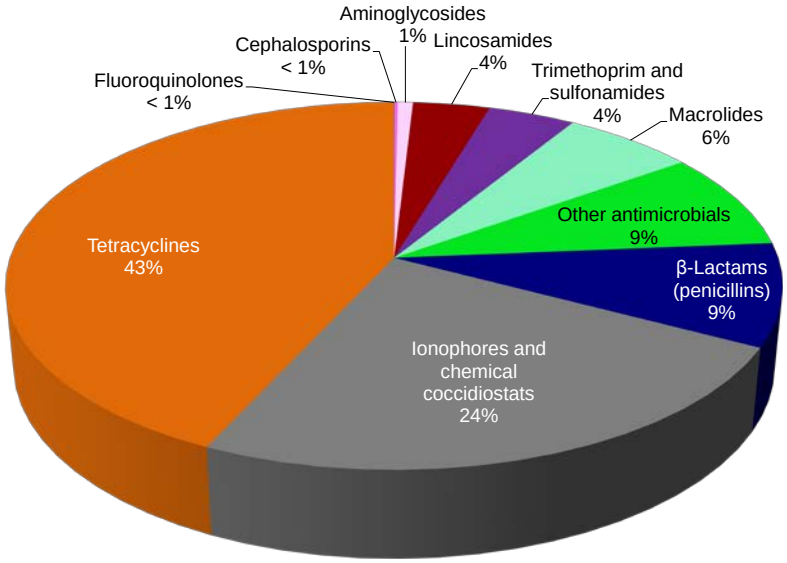




Values do not include own use imports or active pharmaceutical ingredients used in compounding.
"Other antimicrobials" for 2013 included: bacitracin, bambermycin, chloramphenicol, clavulanic acid, florfenicol, nitrofurantoin, nitrofurazone, novobiocin, ormethoprim, polymixin, tiamulin, and virginiamycin.
Antimicrobial sales were assigned to animal type according to label claim and in the situation where mixed species was indicated on the label, the manufacturer assigned the species as either "Companion animal" or "Production animal".

Figure 3.5. Quantity of antimicrobials (kg) distributed for use in production animals (a) over time and (b) 2013





Note the differences in scale of the vertical axes between the companion animal and the production animal figures.
Values do not include own use imports or active pharmaceutical ingredients used in compounding.
"Other antimicrobials" for 2013 included: bacitracin, bambermycin, chloramphenicol, clavulanic acid, florfenicol, nitrofurantoin, nitrofurazone, novobiocin, ormethoprim, polymixin, tiamulin, and virginiamycin.
Antimicrobial sales were assigned to animal type according to label claim and in the situation where mixed species was indicated on the label, the manufacturer assigned the species as either "Companion animal" or "Production animal". Production animals include horses.

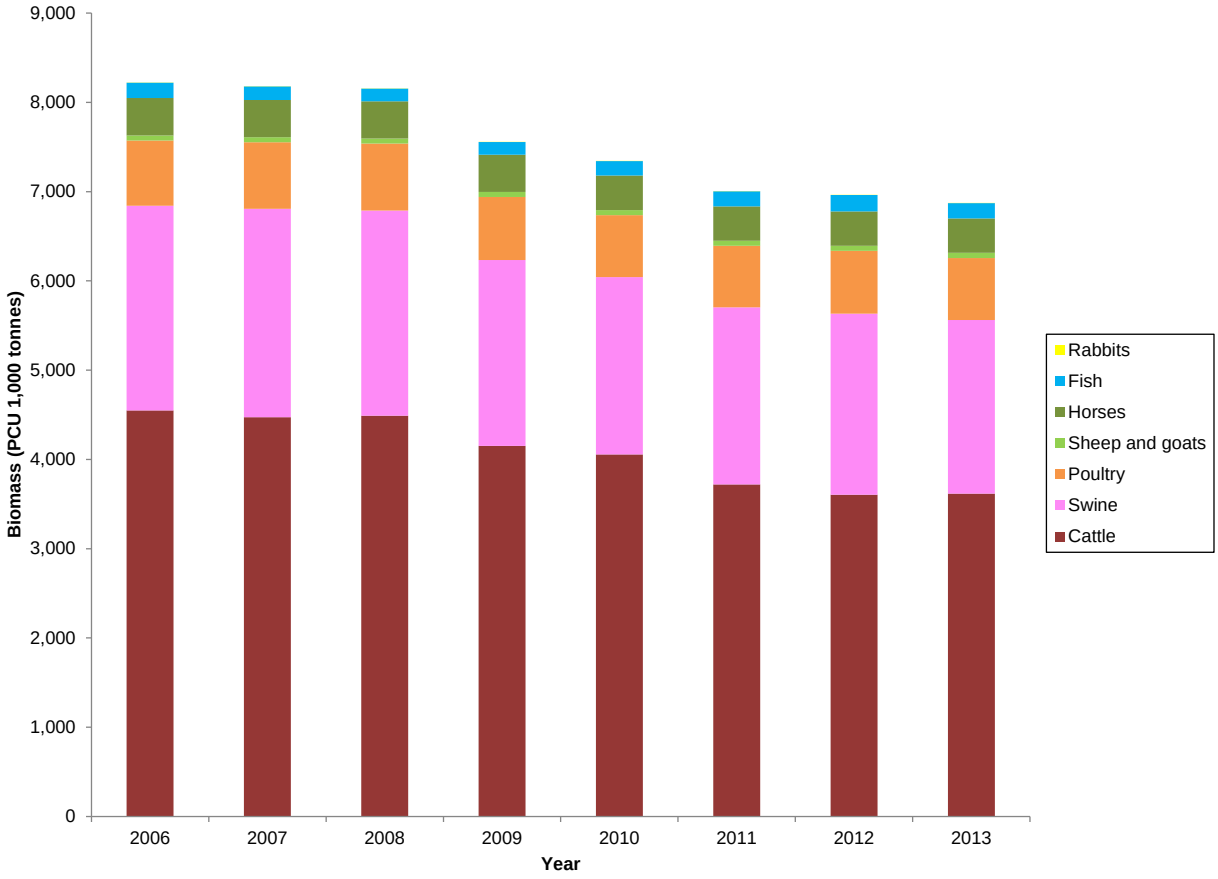
ANTIMICROBIAL SALES AND ANIMAL BIOMASS IN CANADA—THE POPULATION CORRECTION UNIT (PCU) OVER TIME

For more detailed information on data sources and specific information on production stages, imports, exports, please see table at the end of this section.

Table 3.4. Canadian population numbers and population correction unit (PCU), 2013

Animal species	Number of animals and/or kg fish	PCU (1,000 tonnes)
Cattle	8,643,937	3,618
Swine	26,699,102	1,943
Poultry	596,339,432	695
Sheep and goats	1,351,165	57
Horses	963,500	385
Fish	172,097,000	172
Rabbit	582,244	1
Total Production Animals		**6,872**

Figure 3.6. Canadian animal biomass as measured by the population correction unit over time, using European weights and European Surveillance of Veterinary Antimicrobial Consumption production classes, 2006–2013



For 2010 to 2013, the data used for live horses was from 2010; more recent data were unavailable.
Data based on European weights and European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) production classes (no companion animals)[15].

[15] Sales of veterinary antimicrobial agents in 25 EU/EEA countries in 2011 (EMA/236501/2013). European Medicines Agency. European Surveillance of Veterinary Antimicrobial Consumption (ESVAC). Available at: www.ema.europa.eu/docs/en_GB/document_library/Report/2013/10/WC500152311.pdf. Accessed March 2014.

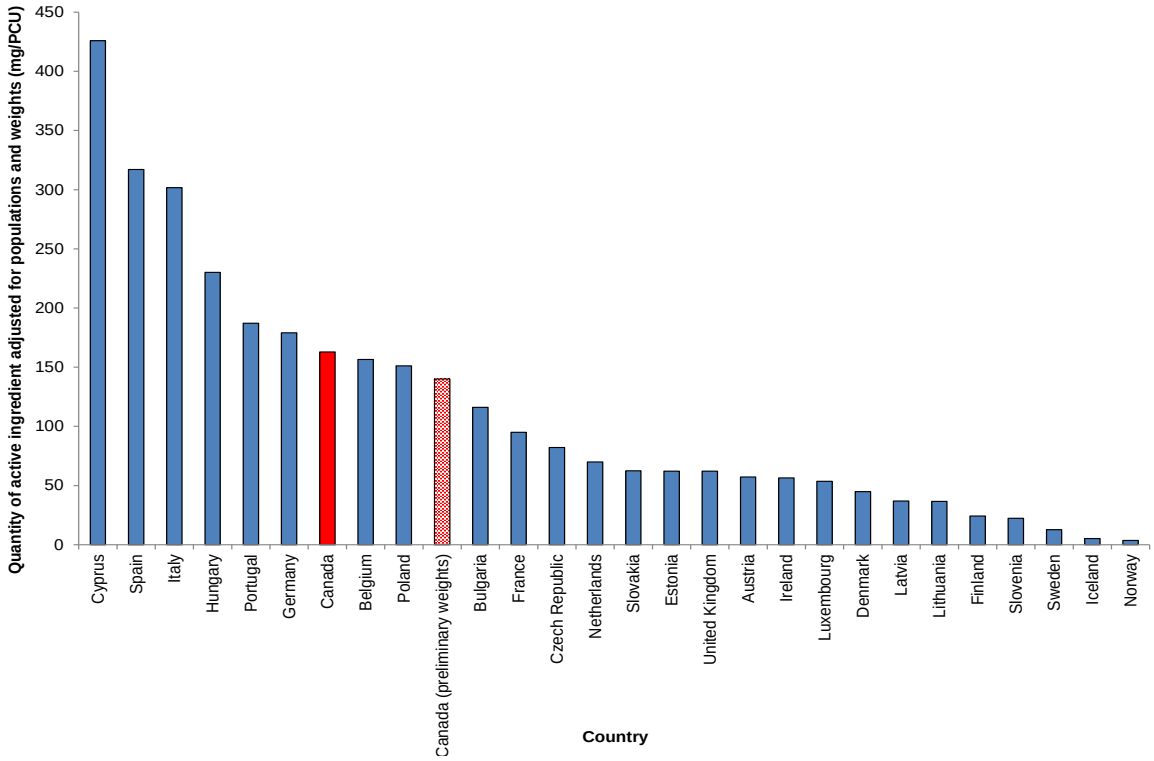
Figure 3.7. Antimicrobials distributed for use in animals over time (kg of active ingredient and mg/PCU), 2006–2013

PCU=population correction unit.
Own-use importation and active pharmaceutical ingredient importation are not included for the Canadian data
Ionophores and chemical coccidiostats were excluded.
*Indicates data excluding antimicrobials sold for use in companion animals.
For 2010 to 2013, the data used for live horses was from 2010; more recent data were unavailable.
European standard weights – European Surveillance of Veterinary Antimicrobial Consumption[16]

[16] European Medicines Agency. European Surveillance of Veterinary Antimicrobial Consumption (ESVAC). Available at: www.ema.europa.eu/docs/en_GB/document_library/Report/2013/10/WC500152311.pdf. Accessed March 2014.

INTERNATIONAL-LEVEL DATA

Figure 3.8. Sales of antimicrobials (adjusted by populations and weights) for Canada and countries participating in the European Surveillance of Veterinary Antimicrobial Consumption network, 2013



PCU=population correction unit.
Own-use importation and active pharmaceutical ingredient importation are not included for the Canadian data.
Ionophores and chemical coccidiostats were excluded.
The PCU denominator was harmonized to the greatest extent possible with the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC)[17]. ESVAC denominator does not include beef cows, whereas in Canada beef cows are a significant population and are included. ESVAC approach excludes companion animal data from the numerator.
Data from all countries shown are using the same average weights at treatment. However, Canadian average weights in many production classes are heavier than European average weights. As per stakeholder request, based on preliminary analysis, the lighter red column for Canada indicates where Canada would rank if Canadian average weights at treatment were used in the calculations. Canadian stakeholder experts are working with CIPARS to refine this analysis.

[17] European Medicines Agency, European Surveillance of Veterinary Antimicrobial Consumption. Sales of veterinary antimicrobial agents in 26 EU/EEA countries in 2013 - Fifth ESVAC Report. (EMA/387934/2015). Available at: http://www.ema.europa.eu/docs/en_GB/document_library/Report/2015/10/WC500195687.pdf. Accessed Oct. 19, 2015.

APPENDIX

Table 3.5. Detailed information on population numbers, 2013

Animal species	Animal class/production class	Production stage	Number of animals	Average wt. at treatment/standard wt. for import/export (kg)[a]	Population Correction Unit (PCU) (1000 tonnes)	PCU (1000 tonnes) total for species
			n	w	(n*w)/(1000 *1000)	(imports are subtracted)
Cattle						
	Cattle	Slaughter; includes data from federal & provincial slaughter plants [b]	2,752,352	425	1,170	3,618
	Calves	Slaughter; includes data from federal & provincial slaughter plants [b]	263,480	140	37	
	Cattle & calves	Cattle/calf import from the US for slaughter [c]	206	425	0	
	Slaughter cattle & calves	Export for slaughter to the US (includes steers, heifers, cows, and bulls) [d]	671,544	425	285	
	Calves	Cattle/calf international import for feeding (includes veal, beef, and dairy) [e]	38,621	140	5	
	Feeder cattle & calves	Export for feeding to US [f]	363,168	140	51	
	Beef cows	On-farm [g]	3,935,200	425	1,672	
	Dairy cows	On-farm [h]	960,500	425	408	
	Total				3,618	
Swine						
	Finishers	Slaughter [i]	20,758,902	65	1,349	1,943
	All swine	International import of hogs (added for periods I and II) [j]	1,200	65	0	
	All swine	International export of hogs [k]	4,753,400	65	309	
	Sows & gilts 6 mo. and over	On-farm; # animals recorded period II, 2011 [l]	1,188,000	240	285	
	Total				1,943	
Poultry						
	Chicken	Slaughter [m]	627,191,910	1	627	695
	Turkey	Slaughter; includes mature turkeys [n]	21,190,736	7	138	
	Live poultry (< 185 g)	Import; includes all poultry (chicken & non-chicken) [o]	32,586,732	0	7	
	Live poultry (> 185 g)	Import; includes all poultry (chicken & non-chicken) [o]	33,922,463	2	68	
	Live poultry (< 185 g)	Export; includes all poultry (chicken & non-chicken) [o]	13,479,305	0	3	
	Live poultry (> 185 g)	Export; includes all poultry (chicken & non-chicken) [o]	986,676	2	2	
	Total				695	
Sheep and goats						
	Sheep/lamb	Slaughter, adding periods I and II [p]	749,600	20	15	57
	Goats	Slaughter; in federally & provincially inspected establishments [q]	63,565	20	1	
	All sheep	International import (country of origin unknown; adding periods I and II) [p]	18,600	20	0	
	All sheep	International export (country unknown; adding periods I and II) [p]	3,900	20	0	
	Ewes	On-farm; # animals recorded Jan. 1, 2014 [r]	552,700	75	41	
	Total				57	
Horses		Living; note this is 2010 data [s]	963,500	400	385	385
Fish						
	Finfish	kg; includes salmon, trout, steelhead, and other; note this is 2012 data [t]	130,337,000	N/A	N/A	172
	Shellfish	kg; includes clams, oysters, mussels, scallops, and other; note this is 2012 data [t]	41,760,000	N/A	N/A	
	Total				172	
Rabbit		Slaughter (federal & provincial) [u]	582,244	1	1	1
Total PCU					6,872	6,872

See corresponding footnotes on next pages.

Table 3.5. Detailed information on population numbers, 2013 (cont'd)

PCU = population correction unit.
N/A = not applicable.
For cattle, it was not possible to stratify the slaughtered animals by weight or type of animal.
For cattle and pigs on farm, the number of animals entered for a calendar year was the number captured Jan. 1 of that calendar year (this was sometimes reported in the previous year's end of year number; e.g. for sows and gilts on farm for Jan. 1, 2009 in the Statistics Canada CANSIM table, this was reported for the second period of 2008).
For horses, data on number of horses on farm were only reported for 2006 & 2010. The assumption was that for 2012 and 2013, the number was the same.
The total PCU and number of animals are added across the animal classes and the imports are subtracted.

[a] As per European Surveillance of Veterinary Antimicrobial Consumption (ESVAC), other than for the poultry import and export weights which approximate the weight categories reported by Statistics Canada.

[b] Federal: Agriculture Canada; Red Meat and Livestock, Red Meat Market, Information, Slaughter Reports, Report A009A. Available at: http://www.agr.gc.ca/redmeat-vianderouge/sla-aba_eng.htm; http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?report_format_type_code=21&action=gR&signature=9A70686C154484205ACCCFBB485E0890&pdctc=&r=105&pTpl=1&btnDownload=View; and Provincial: Agriculture Canada; Red Meat and Livestock, Red Meat Market, Information, Slaughter Reports A009E. Available at: http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?report_format_type_code=21&action=gR&signature=DD85626031A067D63E838CB554BC562F&pdctc=&r=111&pTpl=1&btnDownload=View.

[c] Agriculture and Agri-Food Canada ; Red Meat and Livestock, Red Meat Market, Trade, Livestock Imported from US, Annual Report. Available at: http://www.agr.gc.ca/redmeat-vianderouge/rpt/tbl6_eng.htm#cattle.

[d] Agriculture and Agri-food Canada. Red Meat and Livestock, Red Meat Market Information, Imports/Exports, Annual Livestock Trade with the US., Exports of Cattle, Calves, Sheep and Hogs to the United States (number of head). Available at: http://www.agr.gc.ca/redmeat-vianderouge/rpt/tbl56_eng.htm#Exports

[e] Agriculture and Agri-Food Canada: Red Meat Market Information, Trade, Livestock Imported from US, Annual Report. Available at: http://www.agr.gc.ca/redmeat/rpt/tbl6_eng.htm#cattle.

[f] Agriculture and Agri-Food Canada: Red Meat Market Information, Imports/Exports, Annual Livestock Trade with the US., Red Meat Market Information. Available at: http://www.agr.gc.ca/redmeat-vianderouge/rpt/tbl56_eng.htm#Exports.

[g] Statistics Canada. Table 003-0032—Number of cattle, by class and farm type, annual (head), CANSIM (database). Available at: http://www5.statcan.gc.ca/cansim/a26?id=0030032&p2=17&retrLang=eng&lang=eng. Accessed November 12, 2014.

[h] Statistics Canada. Table 003-0032—Number of cattle, by class and farm type, annual (head), CANSIM (database). Available at: http://www5.statcan.gc.ca/cansim/a26. Accessed November 12, 2014

[i] Agriculture and Agri-food Canada : Red Meat and Livestock, Red Meat Market Information, Slaughter Reports, Report A005C. Available at: http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?action=pR&pdctc=&r=93.

[j] Statistics Canada. Table 003-0102—Hogs statistics, supply and disposition of hogs, semi-annual (head), CANSIM (database). Available at: http://www5.statcan.gc.ca/cansim/a26?id=0030102&p2=9&tabMode=dataTable&p1=-1&retrLang=eng&srchLan=-1&lang=eng. Accessed November 12, 2014.

[k] Statistics Canada. Table 003-0102—Hogs statistics, supply and disposition of hogs, semi-annual (head), CANSIM (database). Available at: http://www5.statcan.gc.ca/cansim/a26?id=0030102&p2=9&tabMode=dataTable&p1=-1&retrLang=eng&srchLan=-1&lang=eng. Accessed November 12, 2014.

[l] Statistics Canada, CANSIM, table 003-0100. Available at: http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/prim51a-eng.htm.

[m] Agriculture and Agri-food Canada: Statistics and Market Information, By Product (Sector)Poultry and Eggs, Poultry and Egg Market Information, Poultry Slaughter, Report 001. Available at: http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?report_format_type_code=21&action=gR&signature=5C5B526BEB09A03C6F9ABAA92D680306&pdctc=&r=1&pTpl=1&btnDownload=View.

Table 3.5. Detailed information on population numbers, 2013 (cont'd)

[n] Agriculture and Agri-food Canada, Canadian Food Inspection Agency, as compiled by AAFC, AID, Poultry Section; Statistics and Market Information, By Product (Sector)Poultry and Eggs, Poultry and Egg Market Information, Poultry Slaughter, Report 001; http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?report_format_type_code=21&action=gR&signature=780CCBC5939EBF13F33B4425F51C9060&pdctc=&r=1&pTpl=1&btnDownload=View.

[o] Statistics Canada: Statistics and Market Information By Product (Sector) Poultry and Eggs Poultry and Egg Market Information - Canadian Industry Imports and Exports Statistics Canada Poultry and Egg Trade Reports 2013 Poultry and Egg Trade Balance Reports: .http://www.agr.gc.ca/eng/industry-markets-and-trade/statistics-and-market-information/by-product-sector/poultry-and-eggs/poultry-and-egg-market-information-canadian-industry/imports-and-exports/statistics-canada-poultry-and-egg-trade-reports/2013-poultry-and-egg-trade-balance-reports/?id=1396879291628.

[p] Statistics Canada. Table 003-0094—Sheep statistics, supply and disposition of sheep and lambs, annual (head), CANSIM (database). Available at: http://www5.statcan.gc.ca/cansim/a26?id=0030094&p2=9&tabMode=dataTable&p1=-1&retrLang=eng&srchLan=-1&lang=eng. Accessed November 12, 2014.

[q] Agriculture and Agri-food Canada: Statistics and Market Information, By Product (Sector)Red Meat and Livestock, Red Meat Market Information, Slaughter, Annual Goats Slaughtered in Federally and Provincially Inspected Establishments in Canada. Available at: http://www.agr.gc.ca/redmeat-vianderouge/rpt/tbl36a_eng.htm.

[r] Statistics Canada. Table 003-0031—Number of sheep and lambs on farms, annual (head), CANSIM (database). Available at: http://www5.statcan.gc.ca/cansim/a26?id=0030031&p2=9&tabMode=dataTable&p1=-1&retrLang=eng&srchLan=-1&lang=eng.

[s] Equine Canada: Industry Study 2010. Available at: http://www.equinecanada.ca/industry/index.php?option=com_content&view=section&id=103&Itemid=559&lang=en.

[t] Statistics Canada. Table 003-0001—Aquaculture, production and value, annual, CANSIM (database). Available at: http://www5.statcan.gc.ca/cansim/a26?id=0030001&p2=9&tabMode=dataTable&p1=-1&retrLang=eng&srchLan=-1&lang=eng. Accessed December 1, 2014.

[u] Agriculture and Agri-food Canada; Statistics and Market Information, By Product (Sector)Red Meat and Livestock, Red Meat Market Information, Alternative Livestock, Rabbit Supply – Canada. Available at: http://www.agr.gc.ca/eng/industry-markets-and-trade/statistics-and-market-information/by-product-sector/red-meat-and-livestock/red-meat-and-livestock-market-information/supply-sheets-by-species/rabbit-industry-at-a-glance/?id=1415860000120.