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Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)

2005

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PRELIMINARY RESULTS



Canada

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About CIPARS 2005 Preliminary Results

For the first time we are web-posting preliminary antimicrobial resistance findings for the most recent complete calendar year (2005). Data from the following program components are available:

- **Enhanced Passive Surveillance of Human Clinical Isolates**
- **Active Abattoir Surveillance**
- **Active Retail Meat Surveillance**
- **Passive Surveillance of Animal Clinical Isolates**

Final results, which may differ slightly from those posted in this preliminary web-report, will be presented in the 2005 CIPARS Annual Report. The full annual report will include integrated data on *Escherichia coli* and *Salmonella* antimicrobial resistance across humans and animal commodities, and a description of temporal changes. The 2005 Annual Report is scheduled for publication in mid-2007.

Enhanced Passive Surveillance of Human Clinical Isolates

The *Enhanced Passive Surveillance of Human Clinical Isolates* component is designed to provide representative data on *Salmonella* isolates at the provincial level. To ensure statistically valid sampling, all human *Salmonella* isolates (outbreak and non-outbreak) received by the provincial public health laboratories in New Brunswick, Newfoundland, Nova Scotia, Manitoba, Prince Edward Island, and Saskatchewan are forwarded to the National Microbiology Laboratory of the Public Health Agency of Canada in Winnipeg, Manitoba. More populated provinces (Alberta, British Columbia, Ontario, and Québec) forward isolates received from the first to the 15th of each month. In addition, all human isolates of *S. Newport* and *S. Typhi* are forwarded to the National Microbiology Laboratory because of concerns of emerging multi-drug resistance and clinical importance respectively. Please see the link to our past annual reports for a listing of all participating laboratories (<http://www.phac-aspc.gc.ca/cipars-picra/index.html>).

In 2005, provincial public health laboratories forwarded a total of 3416 *Salmonella* isolates to the National Microbiology Laboratory for phage typing and susceptibility testing, of which 133 isolates were classified as being related to an outbreak of *S. Enteritidis* in Ontario. All but one of these outbreak-related isolates were excluded and analysis was conducted on 3284 *Salmonella* isolates.

Note: In Canada, while there are legislative requirements to report all new cases of salmonellosis to local and provincial public health authorities, forwarding of isolates from these cases by local laboratories is voluntary. When interpreting CIPARS data, it should be noted that most but not all isolates from reported cases are sent to provincial public health laboratories for reference testing. The total number of *Salmonella* isolates by serovar must be considered when interpreting the proportion of resistant isolates. Other limitations of passive surveillance data include disease under-diagnosing and under-reporting, which can lead to underestimating the true incidence of salmonellosis cases.

Active Abattoir Surveillance (bovine, chickens and swine)

The *Active Abattoir Surveillance* component is designed to provide nationally representative antimicrobial resistance data from bacteria isolated from animals entering the food chain. We sample caecal contents of slaughtered food-producing animals, as caecal contents more accurately reflect the farm of origin of the animal than carcass samples exposed to cross-contamination. This program began in September 2002. Initially, we targeted *E. coli* and *Salmonella* from beef cattle, swine, and broiler chicken. Program refinement since 2002 has included the discontinuation of *Salmonella* isolation from beef cattle due to low

prevalence (less than one percent) and the addition of *Campylobacter* isolation from beef cattle in September of 2005.

Over 90% of all food-producing animals in Canada are slaughtered in federally inspected abattoirs. Fifty-four federally inspected slaughter plants (28 poultry plants, 18 swine plants, and 8 beef cattle plants) from across Canada participated in the 2005 CIPARS abattoir component. Veal is excluded from our actual sampling program. The “Beef Cattle” dataset may include a small number of samples from dairy cattle, as a small number of plants slaughter both commodities.

Our collection periods are uniformly distributed over a 12-month course to avoid any potential seasonal bias in bacteria prevalence and antimicrobial susceptibility. Our sampling program is designed to yield approximately 150 isolates per targeted bacterial and animal species per year across Canada. Please refer to our 2004 Annual Report for more information regarding the design of the sampling plan. All samples are shipped to the Laboratory for Foodborne Zoonoses, Saint-Hyacinthe, Québec to be processed.

Active Retail Meat Surveillance (beef, chicken, and pork)

The objective of our *Active Retail Meat Surveillance* component is to examine antimicrobial resistance of selected bacteria found in raw meat at retail. Retail sampling provides a measure of human exposure to antimicrobial resistant bacteria via undercooked meat consumption or cross-contamination with raw meat products. In 2005, we collected samples in Ontario, Québec, and Saskatchewan.

We are interested in bacterial isolates cultured from specific meat products commonly consumed by Canadians, and these products mirror the commodities sampled in our *Active Abattoir Surveillance* program and our developing *On-Farm Surveillance* program. We sample poultry (chicken legs or wings), pork (shoulder chops), and beef (ground beef). For ground beef, we systematically select samples from extra lean, lean, and regular ground beef to reflect the heterogeneity of this product in terms of the commodity combinations of fed beef and cull dairy, and the domestic vs. imported meat content.

The bacteria of interest in poultry are *Campylobacter*, *Salmonella*, *Enterococcus*, and *Escherichia coli*. In pork and beef we only isolate *E. coli*, since there is a low prevalence of *Campylobacter* and *Salmonella* (less than three percent each) at retail in these commodities, as determined during the early phase of the program.

The sampling protocol involves continuous weekly sample submissions from randomly selected census divisions, weighted by population, in each of the tested provinces. Using prevalence estimates from the previous year, our sampling protocols are designed to yield approximately 100 isolates per commodity per province per year, plus 20% for lost or damaged samples. Please see our previous annual reports for further sampling details (<http://www.phac-aspc.gc.ca/cipars-picra/index.html>). Our 2005 Annual Report will additionally include our sampling strategy for Saskatchewan.

Note: We do not annually collect 100 *Salmonella* isolates for retail chicken as the prevalence of *Salmonella* varies between 7 and 16% and resources to expand our sampling capacity are not available at this point in time. Resource constraints also limit our sampling in Saskatchewan to half of the sampling size in Ontario and Québec.

Passive Surveillance of Animal Clinical Isolates (bovine, chickens, swine and turkeys)

Passive Surveillance of Animal Clinical Isolates component originate primarily from veterinary diagnostic submissions collected by veterinarians and/or producers. These isolates are sent by provincial animal health laboratories across the country to the *Salmonella* Typing Laboratory at the Laboratory for

Foodborne Zoonoses (Guelph, Ontario), where they are serotyped, susceptibility tested, and some additionally phagetyped. Isolates from Québec are serotyped by the Laboratoire d'épidémiologie animale du Québec before being shipped. Please see our 2004 annual report for a listing of participating animal health laboratories (<http://www.phac-aspc.gc.ca/cipars-picra/index.html>).

Note: We receive isolates from all provinces. Unlike our *Enhanced Passive Surveillance of Human Clinical Isolates* program, all isolates received by provincial animal health laboratories may not necessarily be forwarded to the Laboratory for Foodborne Zoonoses, with the exception of the provinces of Ontario and Québec. Coverage may therefore vary considerably between provinces. Most samples are obtained from diseased animals and sample submissions may have followed therapeutic failure. Generally, these animals do not enter the food chain. For these reasons, estimates from these animal isolates are not appropriate for evaluating general human exposure to antimicrobial resistance. Information from these animal isolates is however valuable for detecting emerging resistance patterns, identifying new multi-drug resistance patterns, and assessing the occurrence of resistance in sick animals. Multi-drug resistance patterns will be presented in the final full report.

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Humans

Antimicrobial Resistance in *Salmonella*

Enhanced Passive Surveillance of Human Clinical Isolates

Table 1. Individual antimicrobial drug resistance in human *Salmonella* Enteritidis isolates (n=735) by province¹; Enhanced Passive Surveillance of Human Clinical Isolates, 2005.

Category of human medicine importance	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada
		N=78 n (%)	N=57 n (%)	N=12 n (%)	N=20 n (%)	N=347 n (%)	N=121 n (%)	N=26 n (%)	N=54 n (%)	N=12 n (%)	N=8 n (%)	%
I	amoxicillin-clavulanic acid	1 (1)	1 (2)	0 (0)	0 (0)	1 (0)	1 (1)	2 (8)	0 (0)	0 (0)	0 (0)	<1
	ceftiofur	0 (0)	1 (2)	0 (0)	0 (0)	1 (0)	1 (1)	2 (8)	0 (0)	0 (0)	0 (0)	<1
	ceftriaxone	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ciprofloxacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
II	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	3 (4)	3 (5)	0 (0)	0 (0)	3 (1)	3 (2)	3 (12)	0 (0)	0 (0)	0 (0)	2
	cefoxitin	1 (1)	1 (2)	0 (0)	0 (0)	1 (0)	0 (0)	2 (8)	1 (2)	0 (0)	0 (0)	<1
	gentamicin	2 (3)	0 (0)	0 (0)	0 (0)	2 (1)	0 (0)	1 (4)	0 (0)	0 (0)	0 (0)	<1
	kanamycin	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<1
	nalidixic acid	9 (12)	10 (18)	3 (25)	0 (0)	22 (6)	8 (7)	0 (0)	5 (9)	1 (8)	0 (0)	8
	streptomycin	3 (4)	1 (2)	0 (0)	0 (0)	2 (1)	1 (1)	3 (12)	0 (0)	0 (0)	0 (0)	1
trimethoprim-sulfamethoxazole	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (8)	0 (0)	0 (0)	0 (0)	<1	
III	chloramphenicol	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	2 (8)	0 (0)	0 (0)	0 (0)	<1
	sulfisoxazole	3 (4)	1 (2)	0 (0)	0 (0)	1 (0)	1 (1)	4 (15)	1 (2)	0 (0)	0 (0)	1
	tetracycline	2 (3)	1 (2)	0 (0)	0 (0)	5 (1)	2 (2)	2 (8)	1 (2)	0 (0)	0 (0)	2
IV												

¹Estimated percentage for Canada corrected for non-proportional submission scheme between provinces (See Appendix B.1, 2004 Annual Report).

Table 2. Individual antimicrobial drug resistance in human *Salmonella Heidelberg* isolates (n=409) by province¹; *Enhanced Passive Surveillance of Human Clinical Isolates, 2005.*

Category of human medicine importance	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada
		N=28 n (%)	N=45 n (%)	N=15 n (%)	N=29 n (%)	N=140 n (%)	N=106 n (%)	N=24 n (%)	N=15 n (%)	N=2 n (%)	N=5 n (%)	%
I	amoxicillin-clavulanic acid	10 (36)	6 (13)	0 (0)	5 (17)	42 (30)	37 (35)	9 (38)	8 (53)	0 (0)	0 (0)	29
	ceftiofur	10 (36)	6 (13)	0 (0)	5 (17)	42 (30)	37 (35)	9 (38)	8 (53)	0 (0)	0 (0)	29
	ceftriaxone	0 (0)	0 (0)	0 (0)	0 (0)	3 (2)	1 (1)	1 (4)	0 (0)	0 (0)	0 (0)	1
	ciprofloxacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
II	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	13 (46)	14 (31)	4 (27)	10 (34)	64 (46)	62 (58)	15 (63)	9 (60)	0 (0)	2 (40)	48
	cefoxitin	10 (36)	6 (13)	0 (0)	5 (17)	42 (30)	36 (34)	9 (38)	8 (53)	0 (0)	0 (0)	29
	gentamicin	0 (0)	0 (0)	0 (0)	0 (0)	2 (1)	1 (1)	1 (4)	0 (0)	0 (0)	0 (0)	<1
	kanamycin	0 (0)	1 (2)	0 (0)	0 (0)	2 (1)	1 (1)	1 (4)	0 (0)	1 (50)	0 (0)	1
	nalidixic acid	1 (4)	2 (4)	0 (0)	0 (0)	2 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1
	streptomycin	2 (7)	10 (22)	4 (27)	5 (17)	1 (1)	6 (6)	5 (21)	0 (0)	1 (50)	0 (0)	7
	trimethoprim-sulfamethoxazole	1 (4)	2 (4)	0 (0)	1 (3)	2 (1)	2 (2)	2 (8)	0 (0)	0 (0)	1 (20)	2
III	chloramphenicol	1 (4)	2 (4)	0 (0)	1 (3)	1 (1)	0 (0)	1 (4)	0 (0)	0 (0)	0 (0)	1
	sulfisoxazole	2 (7)	3 (7)	0 (0)	2 (7)	6 (4)	6 (6)	3 (13)	0 (0)	0 (0)	1 (20)	5
	tetracycline	3 (11)	9 (20)	1 (7)	9 (31)	6 (4)	10 (9)	2 (8)	2 (13)	1 (50)	0 (0)	10
IV												

¹Estimated percentage for Canada corrected for non-proportional submission scheme between provinces (See Appendix B.1, 2004 Annual Report).

Table 3. Individual antimicrobial drug resistance in human *Salmonella* Newport isolates (n=142) by province; *Enhanced Passive Surveillance of Human Clinical Isolates, 2005.*

Category of human medicine importance	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada
		N=12 n (%)	N=17 n (%)	N=2 n (%)	N=3 n (%)	N=76 n (%)	N=21 n (%)	N=7 n (%)	N=0 n (%)	N=0 n (%)	N=4 n (%)	%
I	amoxicillin-clavulanic acid	1 (8)	0 (0)	0 (0)	0 (0)	4 (5)	7 (33)	0 (0)	0 (0)	0 (0)	0 (0)	8
	ceftiofur	1 (8)	0 (0)	0 (0)	0 (0)	4 (5)	7 (33)	0 (0)	0 (0)	0 (0)	0 (0)	8
	ceftriaxone	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (14)	0 (0)	0 (0)	0 (0)	0 (0)	2
	ciprofloxacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
II	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	1 (8)	0 (0)	0 (0)	0 (0)	5 (7)	7 (33)	0 (0)	0 (0)	0 (0)	0 (0)	9
	cefoxitin	1 (8)	0 (0)	0 (0)	0 (0)	4 (5)	7 (33)	0 (0)	0 (0)	0 (0)	0 (0)	8
	gentamicin	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<1
	kanamycin	0 (0)	0 (0)	0 (0)	0 (0)	4 (5)	5 (24)	0 (0)	0 (0)	0 (0)	0 (0)	6
	nalidixic acid	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	streptomycin	1 (8)	0 (0)	0 (0)	0 (0)	6 (8)	7 (33)	0 (0)	0 (0)	0 (0)	0 (0)	10
	trimethoprim-sulfamethoxazole	0 (0)	0 (0)	0 (0)	0 (0)	2 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1
III	chloramphenicol	1 (8)	0 (0)	0 (0)	0 (0)	7 (9)	7 (33)	0 (0)	0 (0)	0 (0)	0 (0)	11
	sulfisoxazole	1 (8)	0 (0)	0 (0)	0 (0)	7 (9)	7 (33)	0 (0)	0 (0)	0 (0)	0 (0)	11
	tetracycline	1 (8)	0 (0)	0 (0)	0 (0)	6 (8)	7 (33)	0 (0)	0 (0)	0 (0)	0 (0)	10
IV												

Table 4. Individual antimicrobial drug resistance in human *Salmonella Paratyphi A* and *B* isolates (n=70) by province¹; *Enhanced Passive Surveillance of Human Clinical Isolates, 2005.*

Category of human medicine importance	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada
		N=21	N=4	N=4	N=4	N=30	N=2	N=1	N=2	N=1	N=1	
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	%
I	amoxicillin-clavulanic acid	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ceftiofur	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ceftriaxone	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ciprofloxacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
II	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	0 (0)	0 (0)	3 (75)	0 (0)	0 (0)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	4
	cefoxitin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	gentamicin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	kanamycin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	nalidixic acid	20 (95)	3 (75)	0 (0)	0 (0)	22 (73)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	71
	streptomycin	1 (5)	0 (0)	3 (75)	0 (0)	0 (0)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	6
trimethoprim-sulfamethoxazole	0 (0)	0 (0)	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2	
III	chloramphenicol	0 (0)	0 (0)	3 (75)	0 (0)	0 (0)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	4
	sulfisoxazole	1 (5)	0 (0)	3 (75)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6
	tetracycline	1 (5)	0 (0)	3 (75)	0 (0)	1 (3)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	7
IV												

¹Estimated percentage for Canada corrected for non-proportional submission scheme between provinces (See Appendix B.1, 2004 Annual Report).

Table 5. Individual antimicrobial drug resistance in human *Salmonella Typhi* isolates (n=121) by province; *Enhanced Passive Surveillance of Human Clinical Isolates, 2005.*

Category of human medicine importance	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada
		N=23 n (%)	N=10 n (%)	N=0 n (%)	N=0 n (%)	N=72 n (%)	N=16 n (%)	N=0 n (%)	N=0 n (%)	N=0 n (%)	N=0 n (%)	%
I	amoxicillin-clavulanic acid	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ceftiofur	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ceftriaxone	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ciprofloxacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
II	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	3 (13)	1 (10)	0 (0)	0 (0)	23 (32)	5 (31)	0 (0)	0 (0)	0 (0)	0 (0)	26
	cefoxitin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	gentamicin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	kanamycin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	nalidixic acid	18 (78)	6 (60)	0 (0)	0 (0)	56 (78)	7 (44)	0 (0)	0 (0)	0 (0)	0 (0)	72
	streptomycin	3 (13)	2 (20)	0 (0)	0 (0)	23 (32)	5 (31)	0 (0)	0 (0)	0 (0)	0 (0)	27
trimethoprim-sulfamethoxazole	3 (13)	1 (10)	0 (0)	0 (0)	22 (31)	5 (31)	0 (0)	0 (0)	0 (0)	0 (0)	26	
III	chloramphenicol	3 (13)	1 (10)	0 (0)	0 (0)	22 (31)	5 (31)	0 (0)	0 (0)	0 (0)	0 (0)	26
	sulfisoxazole	3 (13)	1 (10)	0 (0)	0 (0)	23 (32)	5 (31)	0 (0)	0 (0)	0 (0)	0 (0)	26
	tetracycline	3 (13)	1 (10)	0 (0)	0 (0)	21 (29)	4 (25)	0 (0)	0 (0)	0 (0)	0 (0)	24
IV												

Table 6. Individual antimicrobial drug resistance in human *Salmonella* Typhimurium isolates (n=560) by province¹; Enhanced Passive Surveillance of Human Clinical Isolates, 2005.

Category of human medicine importance	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada
		N=57	N=64	N=10	N=43	N=252	N=113	N=10	N=6	N=0	N=5	%
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	%
I	amoxicillin-clavulanic acid	7 (12)	3 (5)	0 (0)	0 (0)	14 (6)	4 (4)	0 (0)	0 (0)	0 (0)	0 (0)	5
	ceftiofur	7 (12)	4 (6)	0 (0)	0 (0)	9 (4)	3 (3)	0 (0)	1 (17)	0 (0)	0 (0)	4
	ceftriaxone	0 (0)	1 (2)	0 (0)	0 (0)	2 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<1
	ciprofloxacin	2 (4)	1 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<1
II	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	30 (53)	26 (41)	3 (30)	13 (30)	128 (51)	42 (37)	3 (30)	2 (33)	0 (0)	1 (20)	45
	cefoxitin	7 (12)	2 (3)	0 (0)	0 (0)	11 (4)	3 (3)	0 (0)	0 (0)	0 (0)	0 (0)	4
	gentamicin	3 (5)	1 (2)	0 (0)	1 (2)	5 (2)	2 (2)	0 (0)	1 (17)	0 (0)	0 (0)	2
	kanamycin	15 (26)	16 (25)	0 (0)	3 (7)	41 (16)	26 (23)	3 (30)	1 (17)	0 (0)	2 (40)	20
	nalidixic acid	4 (7)	3 (5)	0 (0)	3 (7)	5 (2)	0 (0)	0 (0)	1 (17)	0 (0)	0 (0)	3
	streptomycin	27 (47)	22 (34)	2 (20)	11 (26)	121 (48)	35 (31)	4 (40)	3 (50)	0 (0)	1 (20)	41
	trimethoprim-sulfamethoxazole	14 (25)	2 (3)	0 (0)	0 (0)	18 (7)	7 (6)	0 (0)	3 (50)	0 (0)	0 (0)	8
III	chloramphenicol	23 (40)	14 (22)	2 (20)	11 (26)	101 (40)	33 (29)	0 (0)	1 (17)	0 (0)	1 (20)	34
	sulfisoxazole	28 (49)	28 (44)	2 (20)	13 (30)	138 (55)	45 (40)	5 (50)	5 (83)	0 (0)	1 (20)	48
	tetracycline	27 (47)	24 (38)	2 (20)	14 (33)	144 (57)	50 (44)	3 (30)	4 (67)	0 (0)	2 (40)	49
IV												

¹Estimated percentage for Canada corrected for non-proportional submission scheme between provinces (See Appendix B.1, 2004 Annual Report).

Table 7. Individual antimicrobial drug resistance in “Other Serovars” of human *Salmonella* isolates (n=1247) by province¹; *Enhanced Passive Surveillance of Human Clinical Isolates, 2005.*

Category of human medicine importance	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada
		N=171 n (%)	N=150 n (%)	N=40 n (%)	N=56 n (%)	N=568 n (%)	N=159 n (%)	N=50 n (%)	N=28 n (%)	N=5 n (%)	N=20 n (%)	%
I	amoxicillin-clavulanic acid	7 (4)	2 (1)	0 (0)	1 (2)	12 (2)	6 (4)	2 (4)	2 (7)	0 (0)	0 (0)	3
	ceftiofur	6 (4)	1 (1)	0 (0)	1 (2)	11 (2)	6 (4)	2 (4)	2 (7)	0 (0)	0 (0)	2
	ceftriaxone	2 (1)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<1
	ciprofloxacin	1 (1)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<1
II	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<1
	ampicillin	29 (17)	23 (15)	0 (0)	7 (13)	36 (6)	15 (9)	4 (8)	6 (21)	0 (0)	1 (5)	1
	cefoxitin	5 (3)	1 (1)	0 (0)	1 (2)	7 (1)	6 (4)	2 (4)	2 (7)	0 (0)	0 (0)	2
	gentamicin	4 (2)	0 (0)	0 (0)	3 (5)	5 (1)	1 (1)	0 (0)	1 (4)	0 (0)	0 (0)	1
	kanamycin	6 (4)	4 (3)	1 (3)	1 (2)	2 (0)	3 (2)	0 (0)	0 (0)	0 (0)	0 (0)	1
	nalidixic acid	10 (6)	4 (3)	3 (8)	3 (5)	24 (4)	3 (2)	0 (0)	2 (7)	0 (0)	0 (0)	4
	streptomycin	30 (18)	29 (19)	2 (5)	15 (27)	48 (8)	19 (12)	4 (8)	5 (18)	0 (0)	6 (30)	12
trimethoprim-sulfamethoxazole	13 (8)	2 (1)	2 (5)	3 (5)	14 (2)	3 (2)	0 (0)	2 (7)	0 (0)	0 (0)	3	
III	chloramphenicol	10 (6)	6 (4)	0 (0)	7 (13)	5 (1)	5 (3)	1 (2)	4 (14)	0 (0)	0 (0)	3
	sulfisoxazole	25 (15)	11 (7)	6 (15)	10 (18)	47 (8)	15 (9)	2 (4)	7 (25)	0 (0)	1 (5)	10
	tetracycline	39 (23)	47 (31)	9 (23)	21 (38)	71 (13)	28 (18)	5 (10)	7 (25)	0 (0)	7 (35)	18
IV												

¹Estimated percentage for Canada corrected for non-proportional submission scheme between provinces (See Appendix B.1, 2004 Annual Report).

Table 8. Number of antimicrobials in resistance pattern of human *Salmonella* isolates (n=3284) across provinces and serovars¹; *Enhanced Passive Surveillance of Human Clinical Isolates, 2005.*

Serovar	n (% total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
<i>Enhanced Passive Surveillance of Human Clinical Isolates (n=3284)</i>					
Number of isolates					
British Columbia (n=390)					
Enteritidis	78 (20)	66	12	0	0
Typhimurium	57 (14.6)	21	13	20	3
Heidelberg	28 (7.2)	12	14	2	0
Typhi	23 (5.9)	5	15	3	0
Paratyphi A	21 (5.4)	1	20	0	0
Stanley	16 (4.1)	12	3	1	0
Saintpaul	15 (3.8)	11	4	0	0
Hadar	12 (3.1)	0	11	1	0
Newport	12 (3.1)	11	0	1	0
I 4,5,12:i:-	11 (2.8)	6	4	1	0
Less frequent serovars	117 (30)	86	18	11	2
Total		231	114	40	5
Alberta (n=347)					
Typhimurium	64 (18.4)	30	16	17	1
Enteritidis	57 (16.4)	45	12	0	0
Heidelberg	45 (13)	25	18	1	1
Hadar	30 (8.6)	1	28	1	0
Newport	17 (4.9)	17	0	0	0
Typhi	10 (2.9)	4	5	1	0
Ebrie	9 (2.6)	8	1	0	0
Thompson	9 (2.6)	6	3	0	0
Infantis	8 (2.3)	6	2	0	0
Javiana	7 (2)	6	1	0	0
Less frequent serovars	91 (26.2)	71	15	5	0
Total		219	101	25	2
Saskatchewan (n=83)					
Heidelberg	15 (18.1)	8	7	0	0
Enteritidis	12 (14.5)	9	3	0	0
Typhimurium	10 (12)	7	1	2	0
Braenderup	6 (7.2)	6	0	0	0
I 4,5,12:i:-	6 (7.2)	5	1	0	0
Agona	5 (6)	1	4	0	0
Hadar	4 (4.8)	2	2	0	0
Paratyphi B	4 (4.8)	1	0	3	0
Infantis	3 (3.6)	3	0	0	0
Thompson	3 (3.6)	3	0	0	0
Berta	2 (2.4)	2	0	0	0
Newport	2 (2.4)	2	0	0	0
Oranienburg	2 (2.4)	1	1	0	0
Less frequent serovars	9 (10.8)	6	3	0	0
Total		56	22	5	0
Manitoba (n=155)					
Typhimurium	43 (27.7)	28	4	11	0
Heidelberg	29 (18.7)	9	20	0	0
Enteritidis	20 (12.9)	20	0	0	0
Hadar	9 (5.8)	0	9	0	0
Thompson	7 (4.5)	7	0	0	0
Montevideo	5 (3.2)	5	0	0	0

Muenchen	5 (3.2)	5	0	0	0
Paratyphi A	4 (2.6)	0	4	0	0
Less frequent serovars	33 (21.3)	21	5	7	0
Total		95	42	18	0
Ontario (n=1485)					
Enteritidis	347 (23.4)	321	25	1	0
Typhimurium	252 (17)	95	40	115	2
Heidelberg	140 (9.4)	66	71	3	0
Newport	76 (5.1)	68	3	2	3
Typhi	72 (4.8)	13	37	22	0
Thompson	71 (4.8)	69	2	0	0
Muenchen	38 (2.6)	37	1	0	0
Infantis	36 (2.4)	31	5	0	0
Less frequent serovars	453 (30.5)	342	101	9	1
Total		1042	285	152	6
Québec (n=538)					
Enteritidis	121 (22.5)	110	11	0	0
Typhimurium	113 (21)	55	21	37	0
Heidelberg	106 (19.7)	40	60	6	0
Thompson	29 (5.4)	27	2	0	0
Newport	21 (3.9)	14	0	0	7
Typhi	16 (3)	6	5	5	0
Litchfield	12 (2.2)	10	2	0	0
Less frequent serovars	120 (22.3)	88	26	6	0
Total		350	127	54	7
New Brunswick (n=118)					
Enteritidis	26 (22)	21	3	0	2
Heidelberg	24 (20.3)	8	15	0	1
Typhimurium	10 (8.5)	5	2	3	0
Thompson	8 (6.8)	6	2	0	0
Infantis	7 (5.9)	7	0	0	0
Newport	7 (5.9)	7	0	0	0
Saintpaul	6 (5.1)	6	0	0	0
Hadar	3 (2.5)	0	3	0	0
Litchfield	3 (2.5)	3	0	0	0
S. Paratyphi B var. Java	3 (2.5)	2	0	1	0
Less frequent serovars	21 (17.8)	19	2	0	0
Total		84	27	4	3
Nova Scotia (n=105)					
Enteritidis	54 (51.4)	48	6	0	0
Heidelberg	15 (14.3)	4	11	0	0
S. Paratyphi B var. Java	6 (5.7)	3	1	2	0
Typhimurium	6 (5.7)	1	3	1	1
Less frequent serovars	24 (22.9)	13	10	1	0
Total		69	31	4	1
Prince Edward Island (n=20)					
Enteritidis	12 (60)	11	1	0	0
Heidelberg	2 (10)	1	1	0	0
Infantis	1 (5)	1	0	0	0
Muenchen	1 (5)	1	0	0	0
Paratyphi A	1 (5)	1	0	0	0
Saintpaul	1 (5)	1	0	0	0
Thompson	1 (5)	1	0	0	0
Uganda	1 (5)	1	0	0	0
Total		18	2	0	0
Newfoundland and Labrador (n=43)					

Enteritidis	8 (18.6)	8	0	0	0
Agona	7 (16.3)	7	0	0	0
Hadar	5 (11.6)	0	5	0	0
Heidelberg	5 (11.6)	2	3	0	0
Typhimurium	5 (11.6)	3	1	1	0
Newport	4 (9.3)	4	0	0	0
Thompson	2 (4.7)	1	1	0	0
I 4,5,12:b:-	1 (2.3)	1	0	0	0
IV 45:g,z51:-	1 (2.3)	0	1	0	0
Litchfield	1 (2.3)	1	0	0	0
Muenchen	1 (2.3)	1	0	0	0
Oranienburg	1 (2.3)	1	0	0	0
Paratyphi B	1 (2.3)	0	0	1	0
Stanley	1 (2.3)	0	1	0	0
Total		29	12	2	0
Canada Total		2193	763	304	24

¹Serovars with less than 2% prevalence are categorized as "Less frequent serovars".

Table 9. Details regarding age and province distribution of human *Salmonella* isolates (n=3284); Enhanced Passive Surveillance of Human Clinical Isolates, 2005.

Age distribution n/N (%)	Province n/N (%)
Less than 5 years: 438/3284 (13%)	Alberta: 347/3284 (11%)
5 to 12 years: 357/3284 (11%)	British Columbia: 390/3284 (12%)
13 to 17 years: 167/3284 (5%)	Manitoba: 155/3284 (5%)
18 to 29 years: 601/3284 (18%)	New Brunswick: 118/3284 (4%)
30 to 49 years: 706/3284 (21%)	Newfoundland and Labrador: 43/3284 (1%)
50 to 69 years: 480/3284 (15%)	Nova Scotia: 105/3284 (3%)
70+ years: 268/3284 (8%)	Ontario: 1485/3284 (45%)
	Prince Edward Island: 20/3284 (1%)
	Québec: 538/3284 (16%)
	Saskatchewan: 83/3284 (3%)

Table 10. Details regarding specimen source of the primary human *Salmonella* serovars (n=3284); Enhanced Passive Surveillance of Human Clinical Isolates, 2005.

Specimen source	Enteritidis	Heidelberg	Newport	Paratyphi A and B	Typhi	Typhimurium	Other serovars	Total
	N=735 n (%)	N=409 n (%)	N=142 n (%)	N=70 n (%)	N=121 n (%)	N=560 n (%)	N=1247 n (%)	N=3284 n (%)
Stool	574 (78)	267 (65)	110 (77)	13 (19)	24 (20)	409 (73)	869 (70)	2266 (69)
Blood	17 (2)	47 (11)	2 (1)	30 (43)	71 (59)	15 (3)	42 (3)	253 (8)
Urine	12 (2)	17 (4)	6 (4)	2 (3)		9 (2)	62 (5)	108 (3)
Anatomy	1 (<1)						1 (<1)	2 (<1)
Surgical							1 (<1)	1 (<1)
Tissue	1 (<1)							1 (<1)
Wound							1 (<1)	1 (<1)
Unknown	130 (18)	78 (19)	24 (17)	25 (36)	26 (21)	127 (23)	271 (22)	681 (21)

Chickens

Antimicrobial Resistance in *Salmonella*

Active Abattoir Surveillance

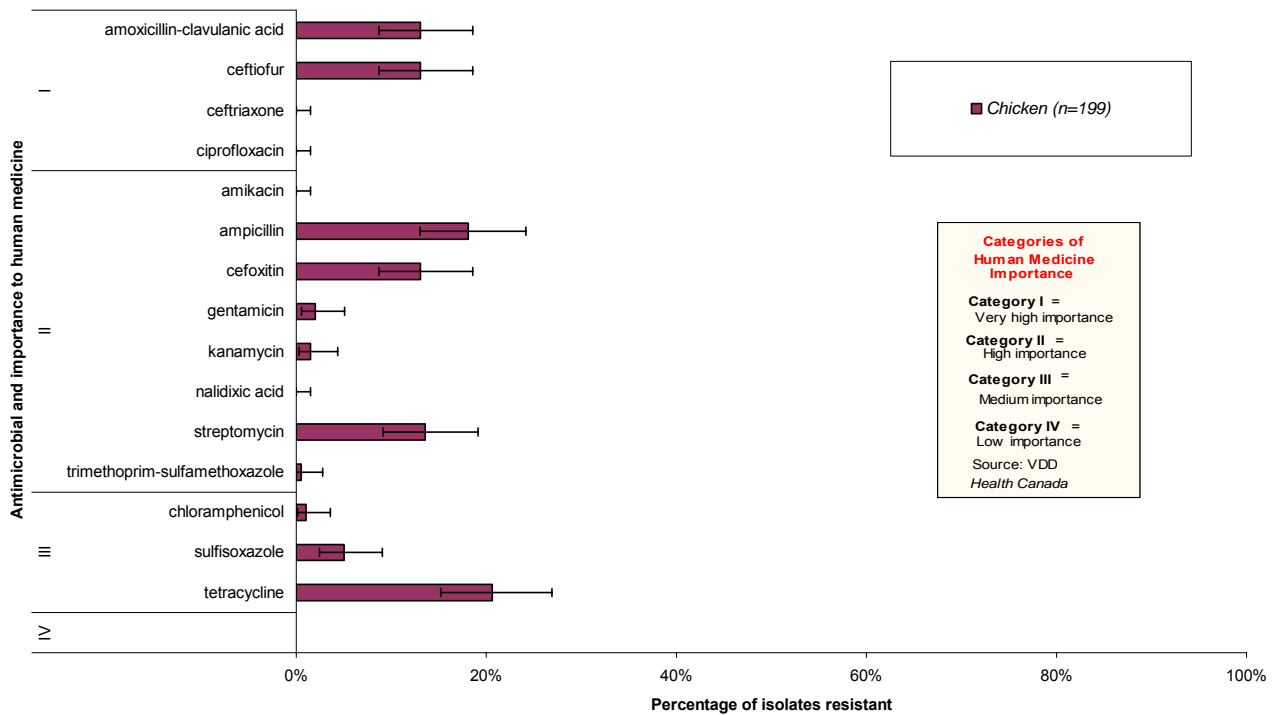


Figure 1. Individual antimicrobial drug resistance in **chicken *Salmonella*** isolates (n=199); **Active Abattoir Surveillance, 2005.**

Table 11. Number of antimicrobials in resistance pattern of chicken *Salmonella* isolates (n=199) across serovars¹; Active Abattoir Surveillance, 2005.

Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
Active Abattoir Surveillance (n=199)		Number of isolates			
Heidelberg	58 (29.1)	36	22	0	0
Kentucky	48 (24.1)	33	15	0	0
Hadar	17 (8.5)	0	17	0	0
Thompson	8 (4)	7	1	0	0
Typhimurium	8 (4)	8	0	0	0
Enteritidis	7 (3.5)	7	0	0	0
Kiambu	7 (3.5)	4	3	0	0
I:4,5,12:i:-	5 (2.5)	2	3	0	0
Infantis	5 (2.5)	2	3	0	0
I:4,12:i:-	4 (2)	3	1	0	0
I:8,20:-:z6	4 (2)	1	3	0	0
Less frequent serovars	28 (14.1)	16	9	3	0
Total		119	77	3	0

¹Serovars with less than 2% prevalence are categorized as "Less frequent serovars".

Active Retail Meat Surveillance

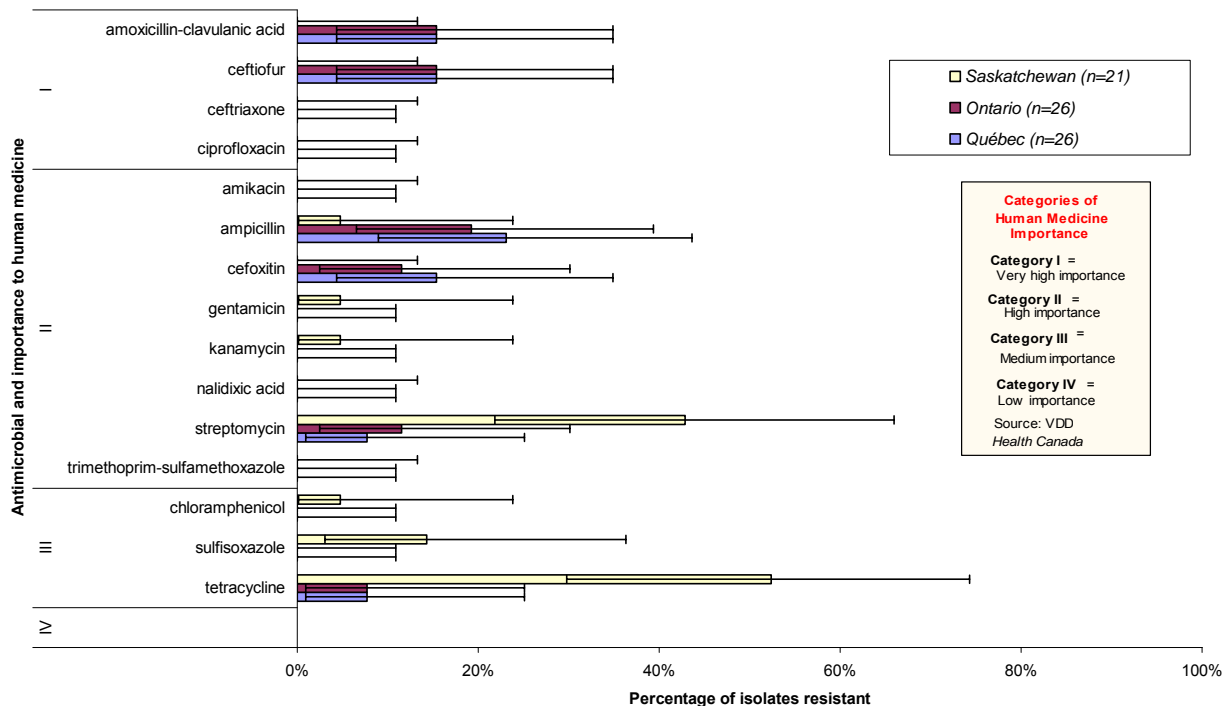


Figure 2. Individual antimicrobial drug resistance in chicken *Salmonella* isolates from Ontario (n=26), Québec (n=26), and Saskatchewan (n=21); Active Retail Meat Surveillance, 2005.

Table 12. Number of antimicrobials in resistance pattern of chicken *Salmonella* isolates from in Ontario (n=26), Québec (n=26), and Saskatchewan (n=21) across serotypes; Active Retail Meat Surveillance, 2005.

Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
Active Retail Meat Surveillance (n=73)		Number of isolates			
Saskatchewan (n=21)					
Hadar	7 (33.3)	0	7	0	0
Heidelberg	5 (23.8)	5	0	0	0
Berta	2 (9.5)	2	0	0	0
Enteritidis	1 (4.8)	1	0	0	0
I:4,12:i:-	1 (4.8)	0	1	0	0
I:4,5,12:i:-	1 (4.8)	0	1	0	0
I:6,8,z10:-	1 (4.8)	0	1	0	0
Infantis	1 (4.8)	1	0	0	0
Kentucky	1 (4.8)	1	0	0	0
Typhimurium var. Copenhagen	1 (4.8)	0	0	1	0
Total		10	10	1	0
Ontario (n=26)					
Heidelberg	11 (42.3)	7	4	0	0
Kentucky	7 (26.9)	5	2	0	0
Enteritidis	1 (3.8)	1	0	0	0
Hadar	1 (3.8)	0	1	0	0
Indiana	1 (3.8)	0	1	0	0
Infantis	1 (3.8)	1	0	0	0
Kiambu	1 (3.8)	1	0	0	0
Senftenberg	1 (3.8)	1	0	0	0
Thompson	1 (3.8)	1	0	0	0
Typhimurium	1 (3.8)	1	0	0	0
Total		18	8	0	0
Québec (n=26)					
Heidelberg	12 (46.2)	6	6	0	0
Kentucky	5 (19.2)	4	1	0	0
Thompson	3 (11.5)	3	0	0	0
Infantis	2 (7.7)	2	0	0	0
Enteritidis	1 (3.8)	1	0	0	0
Hadar	1 (3.8)	0	1	0	0
I:6,7,14:-:1,5	1 (3.8)	1	0	0	0
Litchfield	1 (3.8)	1	0	0	0
Total		18	8	0	0

Antimicrobial Resistance in *Escherichia coli*

Active Abattoir Surveillance

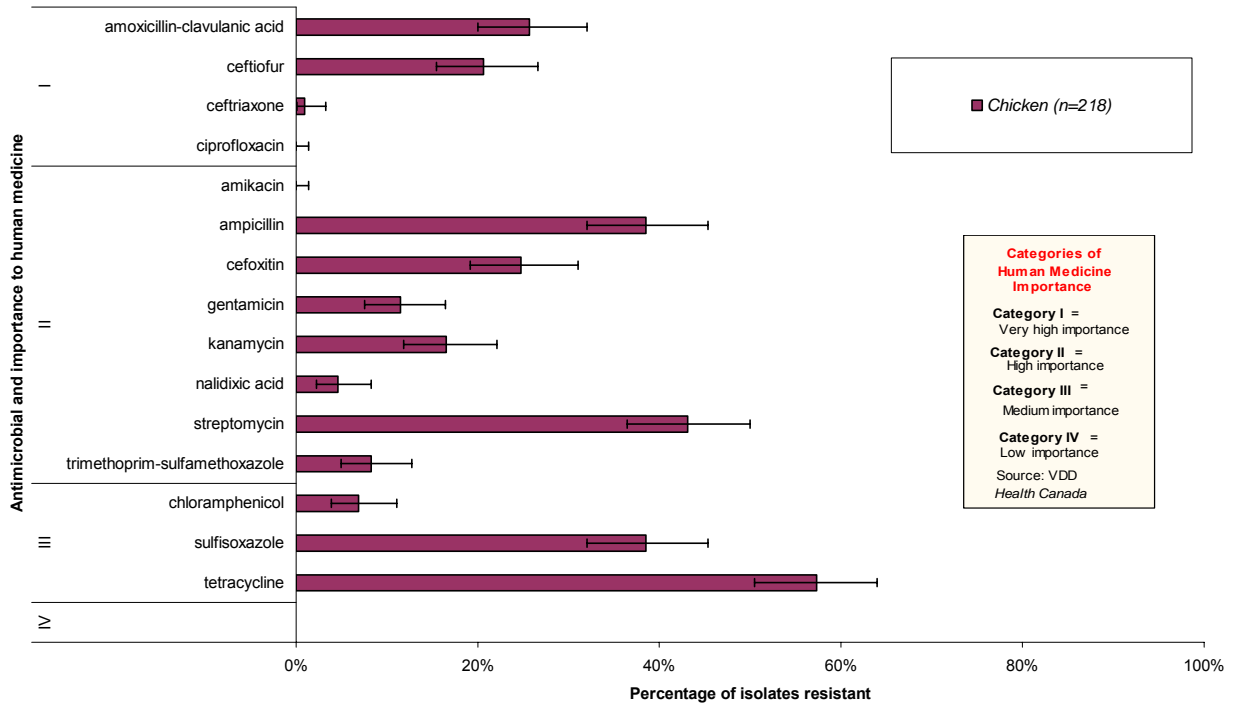


Figure 3. Individual antimicrobial drug resistance in **chicken *E. coli*** isolates (n=218); **Active Abattoir Surveillance, 2005.**

Active Retail Meat Surveillance

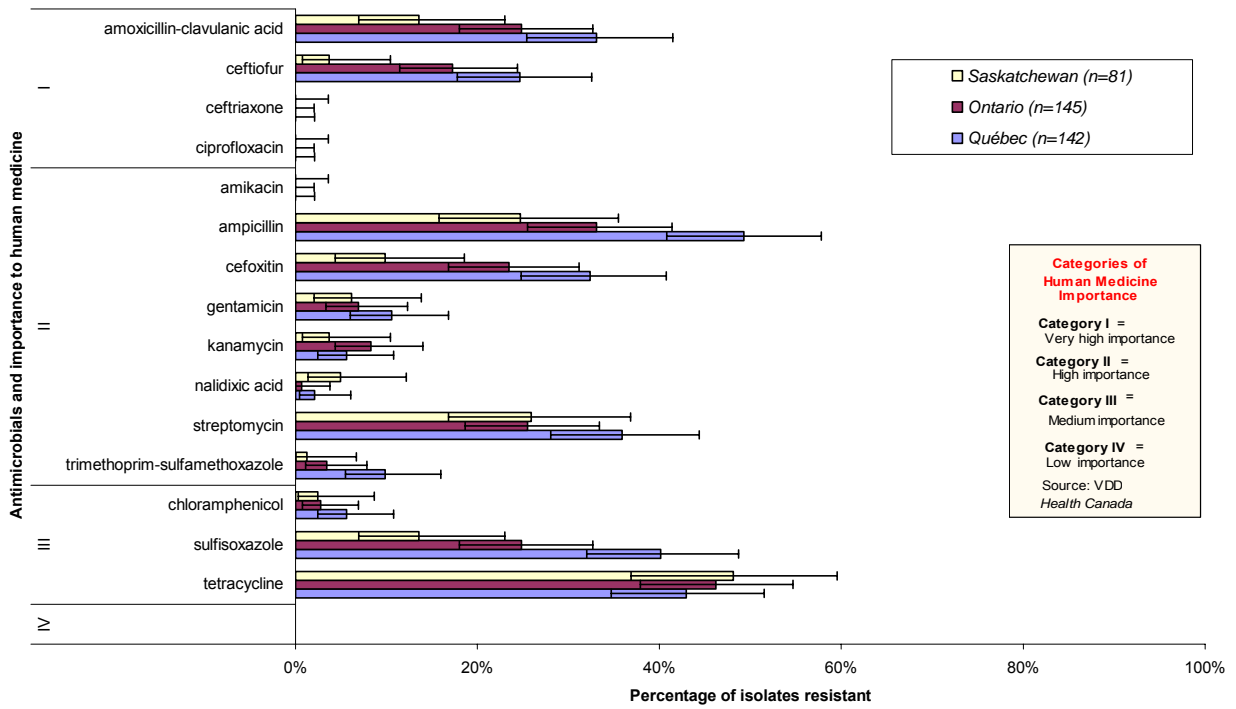


Figure 4. Individual antimicrobial drug resistance in **chicken *E. coli*** isolates from Ontario (n=145), Québec (n=142), and Saskatchewan (n=81); *Active Retail Meat Surveillance, 2005*.

Antimicrobial Resistance in *Campylobacter*

Active Retail Meat Surveillance

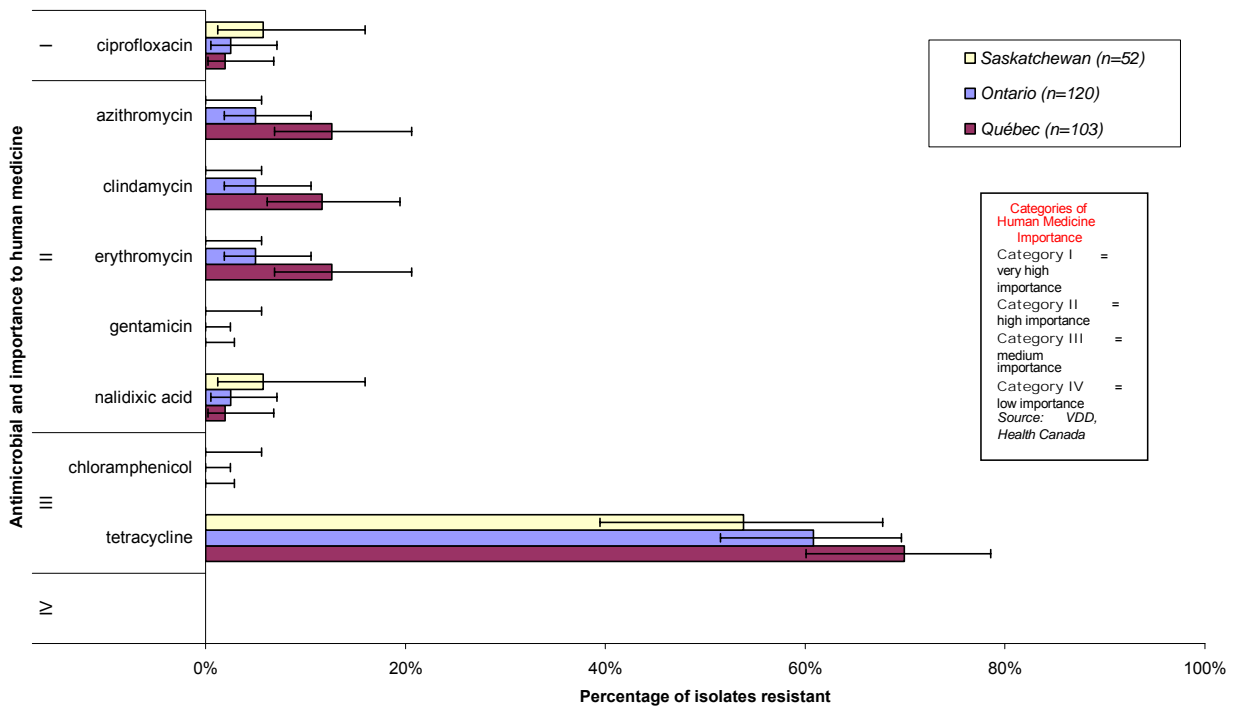


Figure 5. Individual antimicrobial drug resistance in chicken *Campylobacter* isolates from Ontario (n=120), Québec (n=103), and Saskatchewan (n=52); Active Retail Meat Surveillance, 2005.

Table 15. Number of antimicrobials in resistance pattern of chicken *Campylobacter* isolates (n=275) across species; Active Retail Meat Surveillance, 2005.

Species	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
Active Retail Meat Surveillance (n=275)					
Saskatchewan (n= 52)					
<i>Campylobacter jejuni</i>	42 (80.8)	19	23	0	0
<i>Campylobacter spp.</i>	7 (13.5)	2	2	3	0
<i>Campylobacter coli</i>	3 (5.8)	3	0	0	0
Total		24	25	3	0
Ontario (n=120)					
<i>Campylobacter jejuni</i>	100 (83.3)	41	58	1	0
<i>Campylobacter coli</i>	13 (10.8)	3	6	4	0
<i>Campylobacter spp.</i>	7 (5.8)	0	4	3	0
Total		44	68	8	0
Québec (n=103)					
<i>Campylobacter jejuni</i>	86 (83.5)	25	49	12	0
<i>Campylobacter coli</i>	14 (13.6)	3	10	1	0
<i>Campylobacter spp.</i>	3 (2.9)	0	2	1	0
Total		28	61	14	0

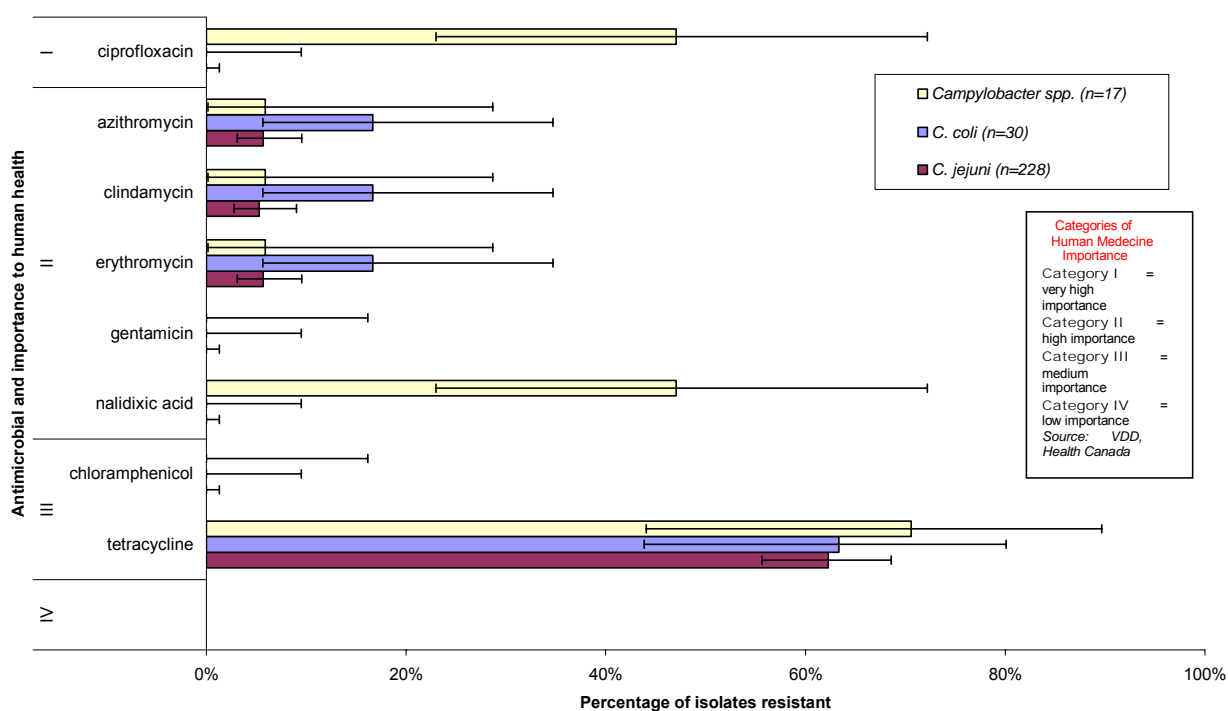


Figure 6. Individual antimicrobial drug resistance in chicken *Campylobacter* isolates (n=275) across species; Active Retail Meat Surveillance, 2005.

Note: *Campylobacter spp.* may include some species that are intrinsically resistant to nalidixic acid.

Antimicrobial Resistance in *Enterococcus*

Active Retail Meat Surveillance

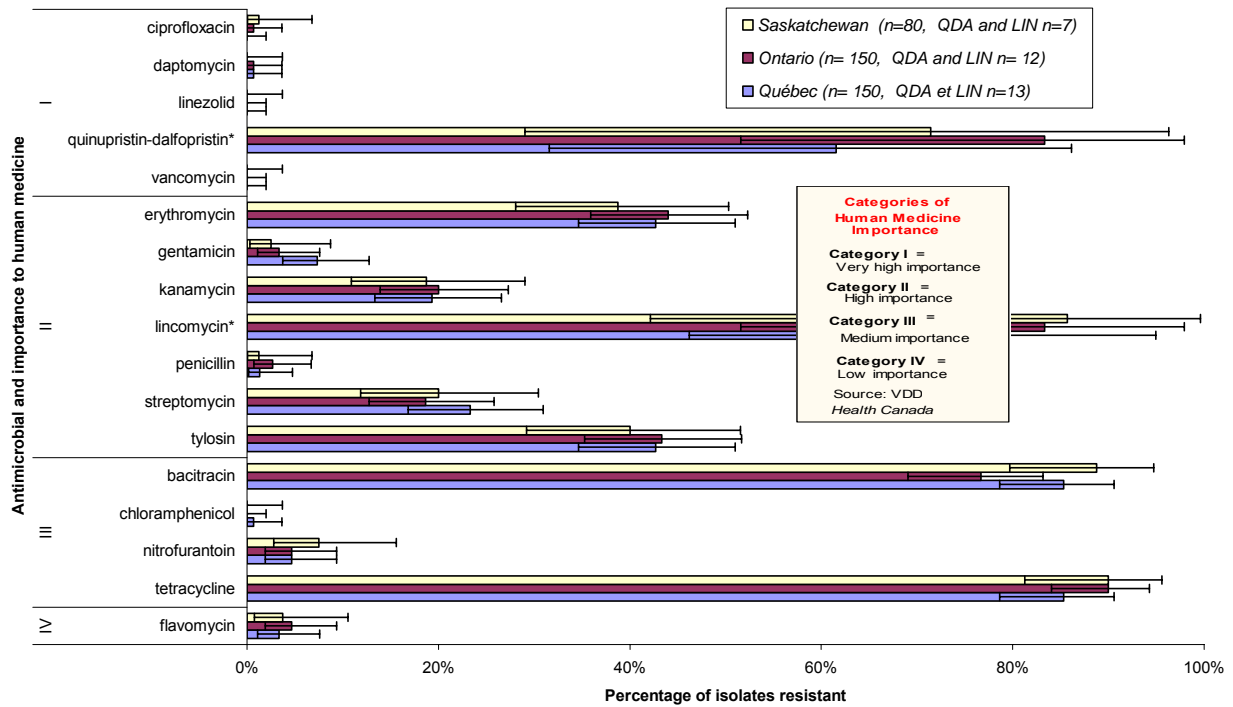


Figure 7. Individual antimicrobial drug resistance in chicken *Enterococcus* isolates from Ontario (n=150), Québec (n=150), and Saskatchewan (n=80); Active Retail Meat Surveillance, 2005.

Note: Resistance to quinupristine-dalfopristine (QDA) and lincomycine (LIN) is not reported for *E. faecalis* because of its intrinsic resistance for these antimicrobials.

Table 16. Number of antimicrobials in resistance pattern of chicken *Enterococcus* isolates (n=380) across species; Active Retail Meat Surveillance, 2005.

Species	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-17
Active Retail Meat Surveillance (n=380)		Number of isolates			
Saskatchewan (n=80)					
<i>E. faecalis</i>	73 (91.3)	4	55	14	0
<i>E. faecium</i>	6 (7.5)	0	1	4	1
<i>Enterococcus spp.</i>	1 (1.3)	0	0	1	0
Total		4	56	19	1
Ontario (n=150)					
<i>E. faecalis</i>	138 (92.0)	8	99	31	0
<i>E. faecium</i>	6 (4.0)	0	0	4	2
<i>Enterococcus spp.</i>	6 (4.0)	0	2	4	0
Total		8	101	39	2
Québec (n=150)					
<i>E. faecalis</i>	137 (91.3)	5	96	36	0
<i>E. faecium</i>	11 (7.3)	0	3	8	0
<i>Enterococcus spp.</i>	2 (1.3)	0	1	1	0
Total		5	100	45	0

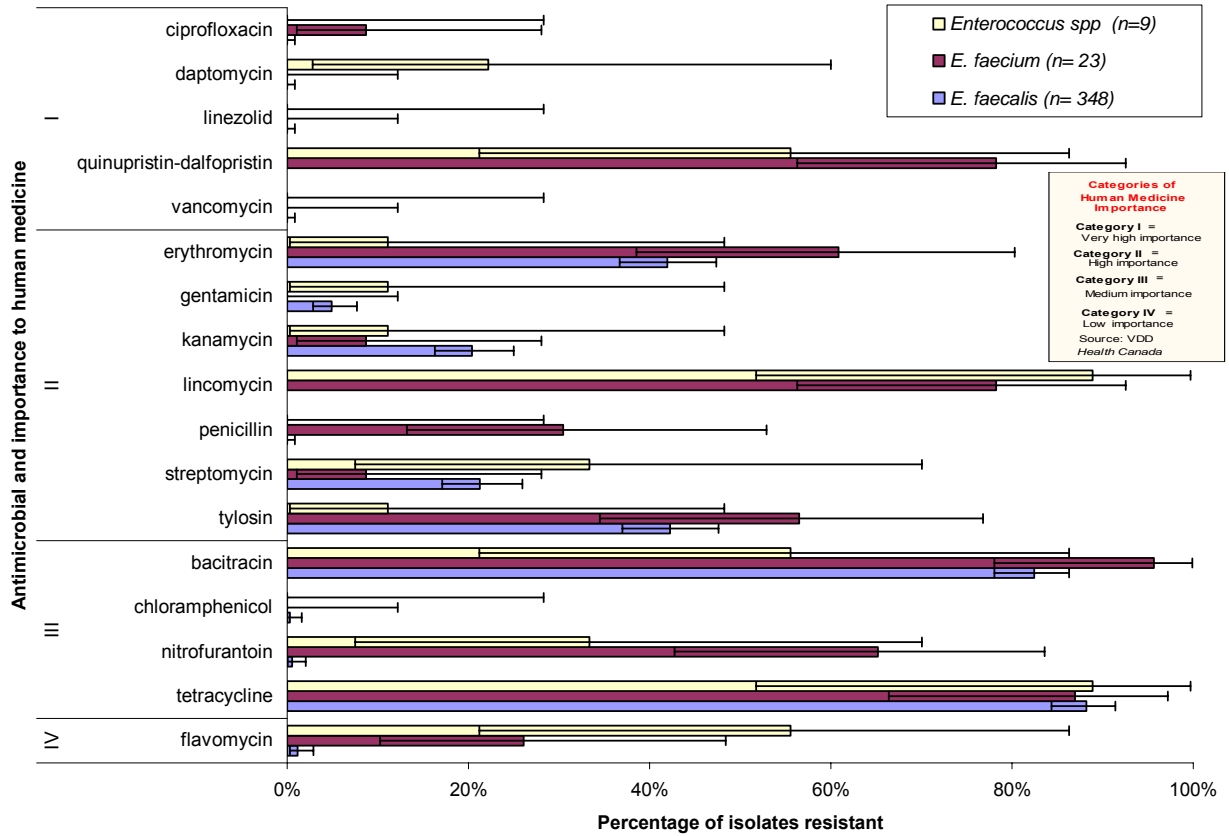


Figure 8. Individual antimicrobial drug resistance in chicken *Enterococcus* isolates (n=380) across species; *Active Retail Meat Surveillance, 2005*.

Swine

Antimicrobial Resistance in *Salmonella*

Active Abattoir Surveillance

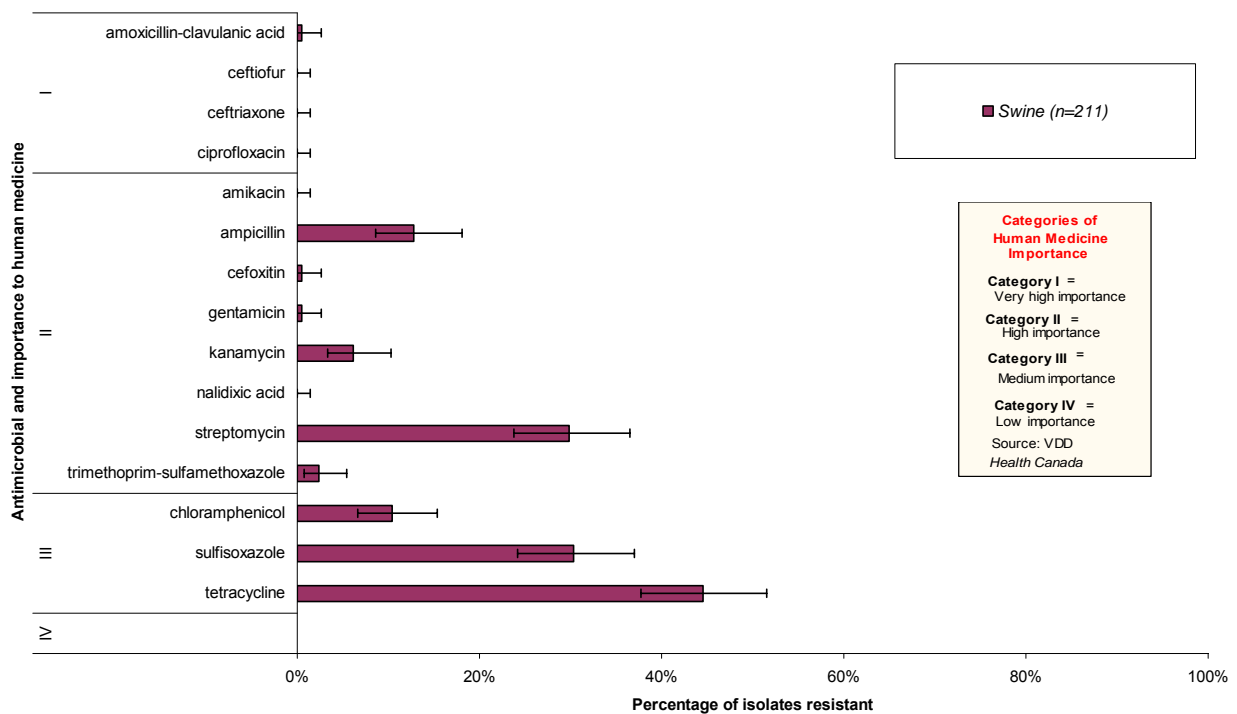


Figure 9. Individual antimicrobial drug resistance in *swine Salmonella* isolates (n=211); Active Abattoir Surveillance, 2005.

Table 19. Number of antimicrobials in resistance pattern of swine *Salmonella* isolates (n=369) across serovars¹; *Passive Surveillance of Animal Clinical Isolates, 2005.*

Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
<i>Passive Surveillance of Animal Clinical Isolates (n=369)</i>		Number of isolates			
Typhimurium	156 (42.3)	15	46	93	2
Typhimurium var. Copenhagen	77 (20.9)	2	15	60	0
Derby	32 (8.7)	3	27	2	0
Senftenberg	19 (5.2)	15	4	0	0
Infantis	12 (3.3)	11	1	0	0
Mbandaka	10 (2.7)	7	1	2	0
Agona	8 (2.2)	1	7	0	0
Brandenburg	8 (2.2)	5	3	0	0
Heidelberg	8 (2.2)	1	2	5	0
Less frequent serovars	39 (10.6)	20	12	7	0
Total		80	118	169	2

¹Serovars with less than 2% prevalence are categorized as "Less frequent serovars".

Antimicrobial Resistance in *Escherichia coli*

Active Abattoir Surveillance

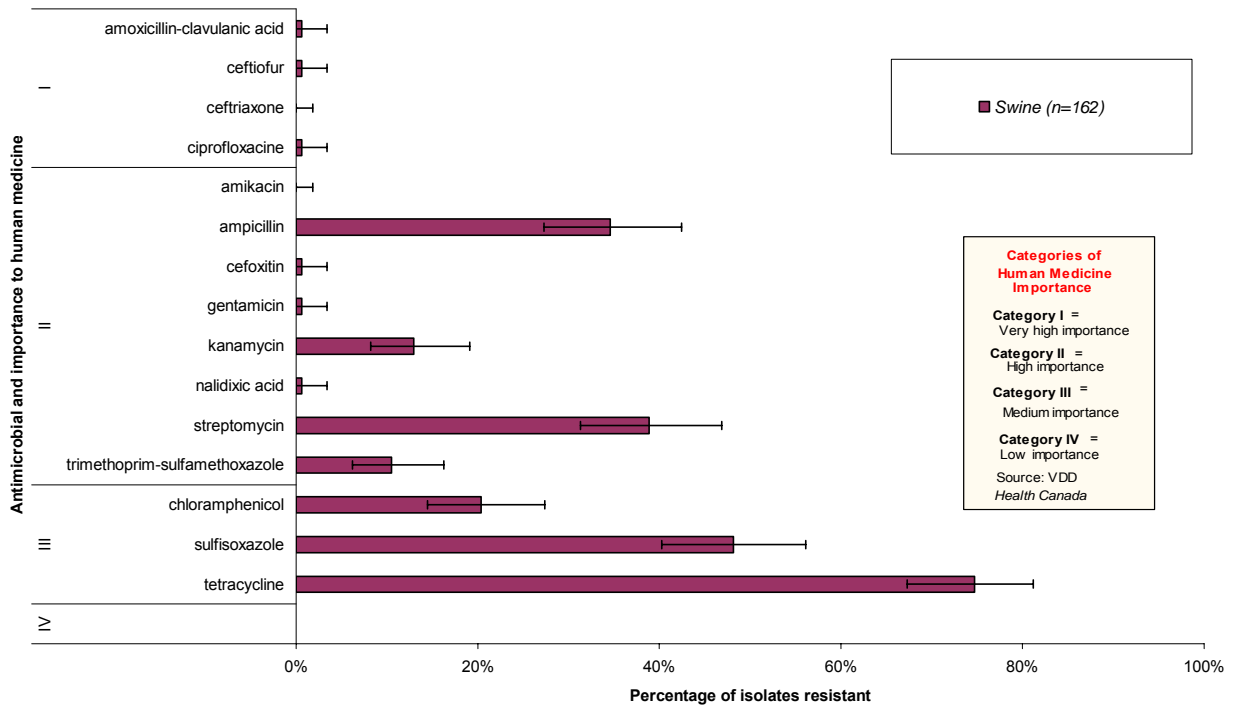


Figure 10. Individual antimicrobial drug resistance in swine *E. coli* isolates (n=162); Active Abattoir Surveillance, 2005.

Active Retail Meat Surveillance

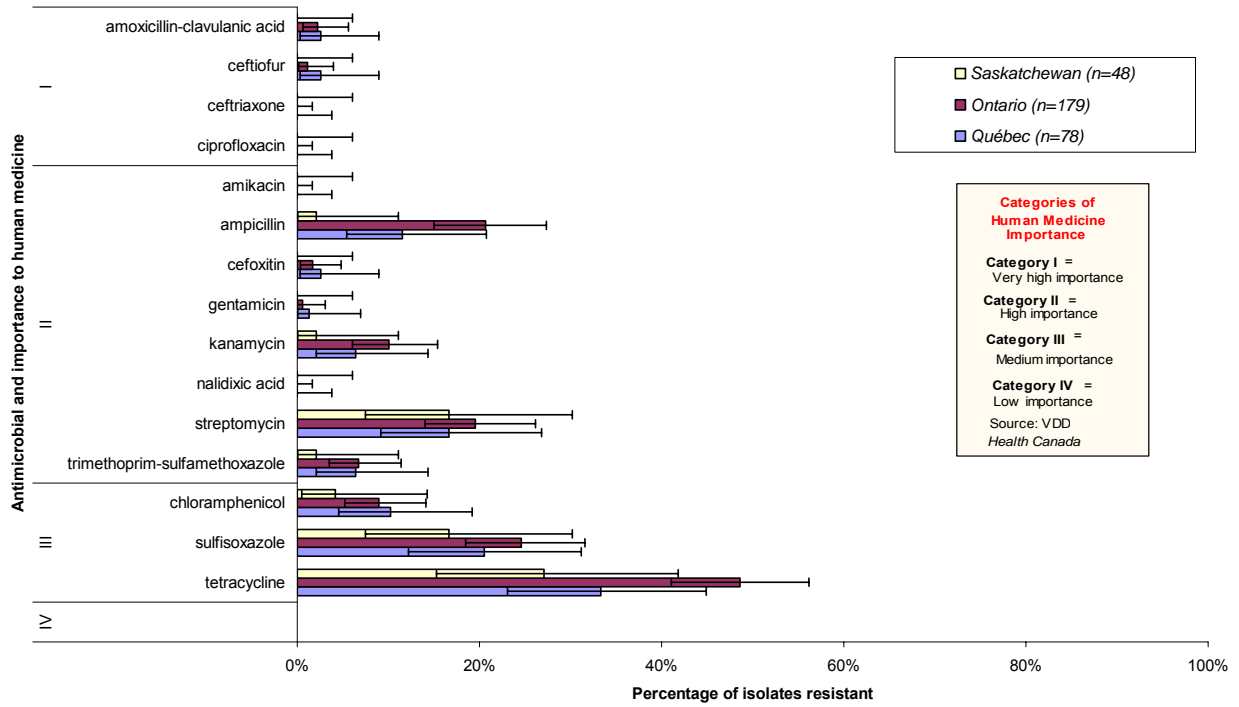


Figure 11. Individual antimicrobial drug resistance in pork *E. coli* isolates from Ontario (n=179), Québec (n=78), and Saskatchewan (n=48); Active Retail Meat Surveillance, 2005.

Bovine

Antimicrobial Resistance in *Salmonella*

Passive Surveillance of Animal Clinical Isolates

Table 20. Distribution of MICs and resistance in bovine *Salmonella* isolates (n=122); Passive Surveillance of Animal Clinical Isolates, 2005.

* Antimicrobial	n	MIC Percentiles			Distribution (%) of MICs															
		MIC ₅₀	MIC ₉₀	%R	≤ 0.015	0.03	0.06	0.12	0.25	0.5	1	2	4	8	16	32	64	128	256	> 256
amoxicillin-clavulanic acid	122	≤ 1	16	0.8						76.2	2.5	1.6	4.9	13.9		0.8				
I ceftiofur	122	0.5	1	0.8				1.6	75.4	22.1				0.8						
ceftriaxone	122	≤ 0.25	≤ 0.25	0.0				99.2						0.8						
ciprofloxacin	122	≤ 0.015	≤ 0.015	0.0	99.2	0.8														
amikacin	122	1	2	0.0					9.8	72.1	15.6	1.6	0.8							
ampicillin	122	≤ 1	> 32	22.1					70.5	6.6	0.8					0.8	21.3			
cefoxitin	122	2	4	0.8					29.5	48.4	18.9	1.6	0.8	0.8	0.8					
gentamicin	122	≤ 0.25	0.5	2.4			66.4	29.5	1.6					0.8	1.6					
II kanamycin	122	≤ 8	> 64	12.3										87.7						12.3
nalidixic acid	122	2	4	0.0						0.8	54.1	41.8	2.5	0.8						
streptomycin	122	≤ 32	64	23.0											77.0	14.8	8.2			
trimethoprim-sulphamethoxazole	122	≤ 0.12	0.25	4.1			70.5	23.8		1.6				4.1						
chloramphenicol	122	4	> 32	19.6							3.3	50.0	25.4	1.6	1.6	18.0				
III sulfizoxazole	122	32	> 256	23.8										27.9	45.1	1.6	1.6			23.8
tetracycline	122	≤ 4	>32	26.2								73.8		1.6	13.9	10.7				

IV

Note: * Roman numerals I-IV indicate the ranking of human medicine importance (VDD). The unshaded fields indicate the range tested for each antimicrobial in the plate configuration. Numbers in bold red fonts indicate the percentage of isolates resistant. Number at the right of the largest dilution are those isolates with growth in all wells within the tested range, indicating the actual MIC is greater than that range of dilutions. The numbers in the smallest dilution of the range tested indicate isolates susceptible to this level or to lower concentration of the antimicrobial. Solid bars represent the resistance breakpoints. Dotted bars represent the susceptibility breakpoints.

Table 21. Number of antimicrobials in resistance pattern of bovine *Salmonella* isolates (n=122) across serovars¹; *Passive Surveillance of Animal Clinical Isolates, 2005.*

Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
<i>Passive Surveillance of Animal Clinical Isolates (n=122)</i>		Number of isolates			
Typhimurium	33 (27.1)	16	4	13	0
Kentucky	27 (22.1)	24	2	1	0
Typhimurium var. Copenhagen	12 (9.8)	2	0	10	0
I:6,14,18:-:-	6 (4.9)	6	0	0	0
Thompson	6 (4.9)	6	0	0	0
Infantis	4 (3.3)	4	0	0	0
Heidelberg	3 (2.5)	3	0	0	0
Rissen	3 (2.5)	0	3	0	0
Schwarzengrund	3 (2.5)	2	0	1	0
Tennessee	3 (2.5)	3	0	0	0
Less frequent serovars	22 (18)	20	2	0	0
Total		86	11	25	0

¹Serovars with less than 2% prevalence are categorized as "Less frequent serovars".

Antimicrobial Resistance in *Escherichia coli*

Active Abattoir Surveillance

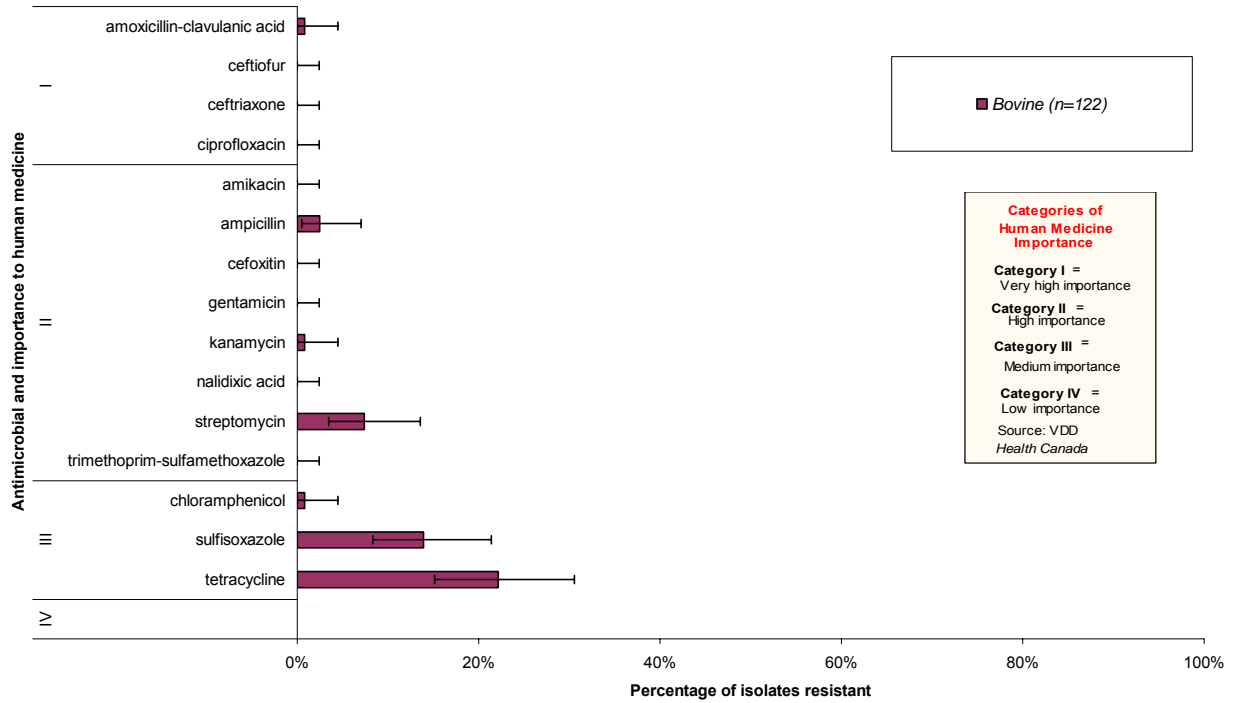


Figure 12. Individual antimicrobial drug resistance in **bovine *E. coli*** isolates (n=122); **Active Abattoir Surveillance, 2005.**

Active Retail Meat Surveillance

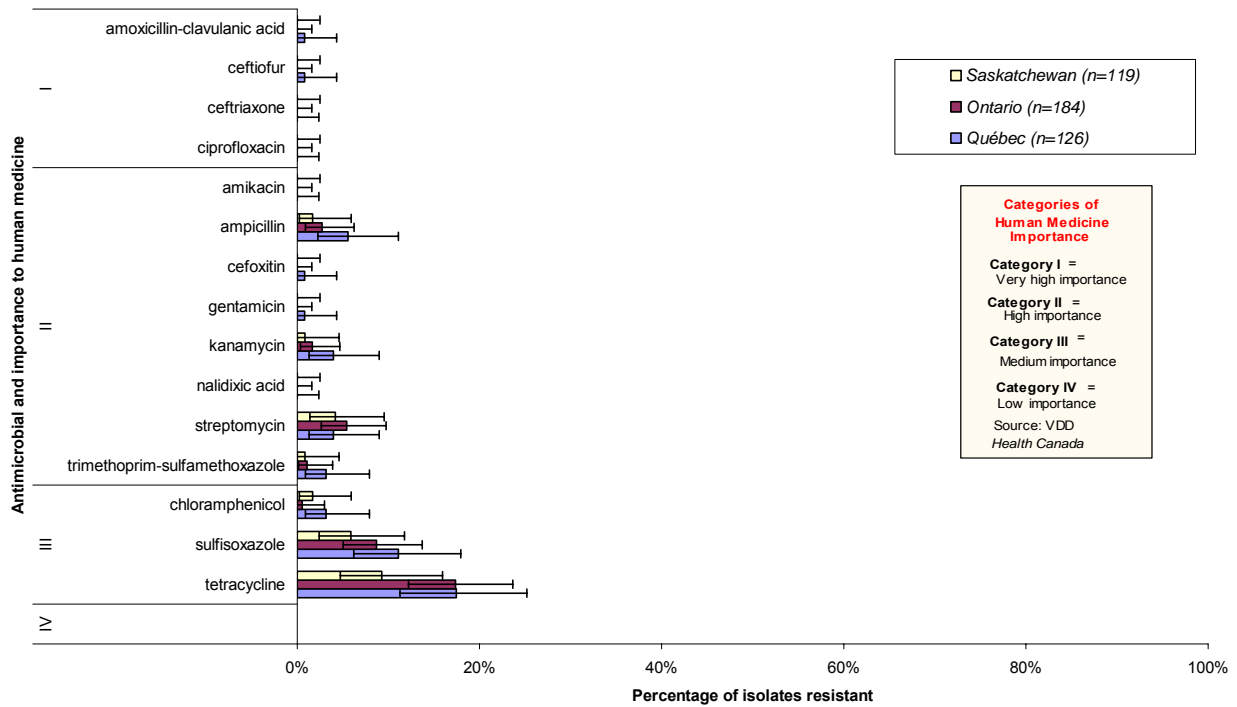


Figure 13. Individual antimicrobial drug resistance in beef *E. coli* isolates from Ontario (n=184), Québec (n=126), and Saskatchewan (n=119); Active Retail Meat Surveillance, 2005.

