



# ***Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS)***

**2006**

## **PRELIMINARY RESULTS**



*... working towards the preservation of effective antimicrobials for humans and animals...*

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**Public Health Agency of Canada**

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## About CIPARS 2006 Preliminary Results

We are posting preliminary antimicrobial resistance findings for the most recent complete calendar year 2006 on the CIPARS website. Unlike our 2005 Preliminary Results, this document also includes summary tables providing recovery rates from 2002 to 2006. Data from the following program components are available:

- ***Surveillance of Human Clinical Isolates***
- ***Abattoir Surveillance***
- ***Retail Meat Surveillance***
- ***Surveillance of Animal Clinical Isolates***

Final results, which may differ slightly from those posted in this preliminary web-report, will be presented in the 2006 CIPARS Annual Report. The full annual report will include integrated data on antimicrobial resistance observed in humans and food animals, temporal changes of antimicrobial resistance since 2003, a summary on multidrug resistance patterns as well as data on the estimated consumption of antimicrobials in the community and in hospitals across Canada.

As in the full annual report, the categorization of antimicrobial drugs (I to IV) presented in this document is based on their importance in human medicine (Veterinary Drugs Directorate, November 2006). All figures and tables presenting individual antimicrobial resistance results are based on this categorization. For further details regarding this classification, please consult this website: [http://www.hc-sc.gc.ca/dhp-mps/consultation/vet/consultations/amr\\_ram\\_hum-med\\_e.html](http://www.hc-sc.gc.ca/dhp-mps/consultation/vet/consultations/amr_ram_hum-med_e.html). Full more complete information on our methodology, please consult the most recent CIPARS Annual Report at: <http://www.phac-aspc.gc.ca/cipars-picra/index.html>.

## CIPARS Surveillance Components

### ***Surveillance of Human Clinical Isolates***

The *Surveillance of Human Clinical Isolate* component is designed to provide representative data on *Salmonella* isolates at the provincial level. All human *Salmonella* isolates 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 15<sup>th</sup> 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 multidrug resistance and clinical importance respectively. Once we produced this document, only a subset of *Salmonella* isolates had been tested. The full annual report will include all isolates received in 2006.

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 surveillance data include disease under-diagnosing and under-reporting, which can lead to underestimating the true incidence of salmonellosis cases.

## **Abattoir Surveillance (chickens, swine, and bovine)**

The *Abattoir Surveillance* component is designed to provide nationally representative antimicrobial resistance data from bacteria isolated from animals entering the food chain. Caecal contents (not carcass) from slaughtered food-producing animals are sampled to avoid misinterpretation related to cross-contamination and to better reflect the antimicrobial resistance at the farm level. All samples are shipped to the PHAC Laboratory for Foodborne Zoonoses for microbiological analyses (Saint-Hyacinthe).

This program was initiated in September 2002 with sampling designed to target *Escherichia coli* and *Salmonella* from beef cattle, swine, and broiler chicken. *Salmonella* recovery from beef cattle was interrupted in 2003 due to low prevalence in this commodity. Program refinement in September 2005 included the addition of *Campylobacter* isolation from beef cattle. These data are presented here for the first time.

Over 90% of all food-producing animals in Canada are slaughtered in federally inspected abattoirs. Fifty-nine federally inspected slaughter plants (28 poultry plants, 18 swine plants, and 13 beef cattle plants) from across Canada participated in the 2006 CIPARS abattoir component. The “beef cattle” dataset may include a small number of samples from dairy cattle, as a small number of plants slaughter both commodities, however veal is excluded.

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 most recent full annual report for more information regarding the design of the sampling plan.

## **Retail Meat Surveillance (chicken, pork, and beef)**

The objective of our *Retail Meat Surveillance* component is to examine antimicrobial resistance of select bacteria found in raw meat at the retail level. Retail sampling provides a measure of human exposure to antimicrobial resistant bacteria via undercooked meat consumption or cross-contamination with raw food products. In 2006, we collected samples in Ontario, Québec, and Saskatchewan.

We are interested in bacterial isolates cultured from specific meat products commonly consumed by Canadians such as poultry (chicken legs or wings), pork (chops), and beef (ground beef). These meat selection mirrors the animal productions studied in the *Abattoir Surveillance* component of our program. For ground beef, we systematically select samples from extra lean, lean, medium 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 *E. coli*. In pork and beef we only perform antimicrobial resistance test on *E. coli*<sup>1</sup>, 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 selected 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.

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<sup>1</sup> We perform *Salmonella* recovery tests from retail pork to obtain a prevalence estimate of contamination, but due to the small number of isolates recovered annually, we do not report antimicrobial resistance in *Salmonella* isolated from pork.

Note: We did not collect 100 *Salmonella* isolates for retail chicken in 2006 as the prevalence of *Salmonella* varied between 12 and 16% and resources to expand our sampling capacity were 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.

## ***Surveillance of Animal Clinical Isolates (chicken, swine, bovine, and turkeys)***

The *Surveillance of Animal Clinical Salmonella Isolates* component originates 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 in some cases, phagetyped. Isolates from Québec are serotyped by the Laboratoire d'épidémiologie animale du Québec before being shipped to the *Salmonella* Typing Laboratory of Guelph where they are phagetyped when appropriate and also tested for antimicrobial resistance.

Note: We receive isolates from all provinces, however the number of submissions varies considerably between provinces. Unlike our *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 of Guelph, with the exception of the provinces of Ontario and Québec. Most samples are obtained from diseased animals and sample submissions may have followed therapeutic failure. Generally, these animals do not enter the food chain. Despite the fact that contamination through direct contact with a diseased animal is possible, we assume that this risk is lower at the national level than exposure through contaminated food. For these reasons, estimates from these animal isolates are judged not appropriate for evaluating general human exposure to antimicrobial resistance. Information from these animal isolates is however valuable for detecting emerging resistance, identifying new multidrug resistance patterns, and assessing the occurrence of resistance in sick animals.

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# Humans

## Antimicrobial Resistance in *Salmonella*

### Surveillance of Human Clinical Isolates

**Table 1. Individual antimicrobial drug resistance in human *Salmonella* Enteritidis isolates by province; *Surveillance of Human Clinical Isolates, 2006.***

	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada <sup>1</sup>
		N=62 n (%)	N=101 n (%)	N=34 n (%)	N=35 n (%)	N=298 n (%)	N=89 n (%)	N=35 n (%)	N=33 n (%)	N=8 n (%)	N=6 n (%)	%
<b>I</b>	amoxicillin-clavulanic acid	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	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
	ceftiofur	0 (0)	0 (0)	1 (3)	0 (0)	1 (0)	0 (0)	0 (0)	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
<b>II</b>	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	3 (5)	6 (6)	2 (6)	1 (3)	6 (2)	3 (3)	0 (0)	0 (0)	0 (0)	0 (0)	3
	cefoxitin	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<1
	gentamicin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	kanamycin	1 (2)	0 (0)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<1
	nalidixic acid	14 (23)	20 (20)	8 (24)	8 (23)	54 (18)	13 (15)	8 (23)	14 (42)	2 (25)	0 (0)	23
	streptomycin	2 (3)	1 (1)	1 (3)	0 (0)	4 (1)	1 (1)	1 (3)	0 (0)	0 (0)	0 (0)	2
trimethoprim-sulfamethoxazole	2 (3)	1 (1)	0 (0)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<1	
<b>III</b>	chloramphenicol	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	<1
	sulfisoxazole	2 (3)	1 (1)	0 (0)	1 (3)	3 (1)	0 (0)	1 (3)	0 (0)	0 (0)	1 (17)	1
	tetracycline	6 (10)	0 (0)	0 (0)	0 (0)	10 (3)	2 (2)	1 (3)	0 (0)	0 (0)	1 (17)	3
<b>IV</b>												

<sup>1</sup> Estimated percentage for Canada corrected for non-proportional submission scheme between provinces (See Method section of previous CIPARS reports).

**Table 2. Individual antimicrobial drug resistance in human *Salmonella* Heidelberg isolates by province; *Surveillance of Human Clinical Isolates, 2006.***

	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada <sup>1</sup>
		N=26	N=46	N=14	N=21	N=123	N=96	N=71	N=16	N=6	N=7	
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	%
<b>I</b>	amoxicillin-clavulanic acid	5 (19)	4 (9)	1 (7)	6 (29)	12 (10)	8 (8)	15 (21)	2 (13)	3 (50)	1 (14)	16
	ceftriaxone	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ceftiofur	5 (19)	4 (9)	1 (7)	6 (29)	12 (10)	8 (8)	15 (21)	2 (13)	3 (50)	1 (14)	16
	ciprofloxacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
<b>II</b>	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	8 (31)	20 (43)	6 (43)	17 (81)	44 (36)	36 (38)	22 (31)	6 (38)	3 (50)	5 (71)	47
	cefoxitin	5 (19)	3 (7)	1 (7)	5 (24)	12 (10)	6 (6)	13 (18)	2 (13)	3 (50)	1 (14)	14
	gentamicin	0 (0)	0 (0)	0 (0)	0 (0)	6 (5)	5 (5)	3 (4)	0 (0)	0 (0)	0 (0)	4
	kanamycin	0 (0)	1 (2)	0 (0)	0 (0)	1 (1)	2 (2)	1 (1)	0 (0)	0 (0)	0 (0)	1
	nalidixic acid	0 (0)	1 (2)	0 (0)	1 (5)	4 (3)	1 (1)	0 (0)	0 (0)	0 (0)	1 (14)	2
	streptomycin	4 (15)	9 (20)	0 (0)	3 (14)	19 (15)	11 (11)	9 (13)	1 (6)	0 (0)	0 (0)	16
	trimethoprim-sulfamethoxazole	0 (0)	0 (0)	0 (0)	0 (0)	5 (4)	4 (4)	0 (0)	0 (0)	0 (0)	1 (14)	3
<b>III</b>	chloramphenicol	0 (0)	0 (0)	0 (0)	1 (5)	2 (2)	1 (1)	1 (1)	1 (6)	0 (0)	0 (0)	2
	sulfisoxazole	2 (8)	1 (2)	0 (0)	1 (5)	12 (10)	11 (11)	1 (1)	2 (13)	0 (0)	0 (0)	8
	tetracycline	7 (27)	12 (26)	3 (21)	3 (14)	10 (8)	12 (13)	6 (8)	2 (13)	0 (0)	1 (14)	16
<b>IV</b>												

Note: Results from Nunavut were not presented in this table as only one isolate resistant to tetracycline was recovered in this province.

<sup>1</sup> Estimated percentage for Canada corrected for non-proportional submission scheme between provinces (See Method section of previous CIPARS reports).

**Table 3. Individual antimicrobial drug resistance in human *Salmonella* Newport isolates by province; *Surveillance of Human Clinical Isolates, 2006.***

	Antimicrobial	BC N=18	AB N=15	SK N=1	MB N=5	ON N=85	QC N=16	NB N=1	NS N=2	PE N=0	NL N=1	Canada
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	%
<b>I</b>	amoxicillin-clavulanic acid	4 (22)	2 (13)	0 (0)	2 (40)	3 (4)	2 (13)	0 (0)	0 (0)	0 (0)	0 (0)	9
	ceftriaxone	1 (6)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1
	ceftiofur	4 (22)	1 (7)	0 (0)	2 (40)	3 (4)	2 (13)	0 (0)	0 (0)	0 (0)	0 (0)	8
	ciprofloxacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
<b>II</b>	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	5 (28)	1 (7)	0 (0)	2 (40)	4 (5)	4 (25)	0 (0)	0 (0)	0 (0)	0 (0)	11
	cefoxitin	4 (22)	1 (7)	0 (0)	2 (40)	3 (4)	2 (13)	0 (0)	0 (0)	0 (0)	0 (0)	8
	gentamicin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	kanamycin	1 (6)	1 (7)	0 (0)	0 (0)	2 (2)	2 (13)	0 (0)	0 (0)	0 (0)	0 (0)	4
	nalidixic acid	1 (6)	0 (0)	0 (0)	0 (0)	4 (5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3
	streptomycin	5 (28)	1 (7)	0 (0)	2 (40)	5 (6)	4 (25)	0 (0)	0 (0)	0 (0)	0 (0)	12
trimethoprim-sulfamethoxazole	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1	
<b>III</b>	chloramphenicol	6 (33)	2 (13)	0 (0)	2 (40)	4 (5)	2 (13)	0 (0)	0 (0)	0 (0)	0 (0)	11
	sulfisoxazole	5 (28)	1 (7)	0 (0)	2 (40)	5 (6)	4 (25)	0 (0)	0 (0)	0 (0)	0 (0)	12
	tetracycline	7 (39)	1 (7)	0 (0)	2 (40)	12 (14)	4 (25)	0 (0)	0 (0)	0 (0)	0 (0)	18
<b>IV</b>												

**Table 4. Individual antimicrobial drug resistance in human *Salmonella Paratyphi A* and *B* isolates by province; *Surveillance of Human Clinical Isolates, 2006.***

	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada <sup>1</sup>
		N=18	N=8	N=0	N=0	N=33	N=7	N=0	N=0	N=0	N=0	%
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
<b>I</b>	amoxicillin-clavulanic acid	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
	ceftiofur	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
<b>II</b>	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)	0 (0)	0 (0)	0 (0)	1 (14)	0 (0)	0 (0)	0 (0)	0 (0)	2
	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	17 (94)	8 (100)	0 (0)	0 (0)	30 (91)	1 (14)	0 (0)	0 (0)	0 (0)	0 (0)	85
	streptomycin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
trimethoprim-sulfamethoxazole	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0	
<b>III</b>	chloramphenicol	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (14)	0 (0)	0 (0)	0 (0)	0 (0)	2
	sulfisoxazole	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (14)	0 (0)	0 (0)	0 (0)	0 (0)	2
	tetracycline	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (14)	0 (0)	0 (0)	0 (0)	0 (0)	2
<b>IV</b>												

Note: Paratyphi A and B. Does not include *S. Paratyphi B* var. *L (+) tartrate+*.

<sup>1</sup> Estimated percentage for Canada corrected for non-proportional submission scheme between provinces (See Method section of previous CIPARS reports).

**Table 5. Individual antimicrobial drug resistance in human *Salmonella Typhi* isolates by province; Surveillance of Human Clinical Isolates, 2006.**

	Antimicrobial	BC N=37	AB N=10	SK N=1	MB N=1	ON N=92	QC N=16	NB N=0	NS N=0	PE N=0	NL N=1	Canada
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	%
<b>I</b>	amoxicillin-clavulanic acid	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)	1 (6)	0 (0)	0 (0)	0 (0)	0 (0)	2
	ceftriaxone	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)	2 (2)	0 (0)	0 (0)	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
<b>II</b>	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	6 (16)	1 (10)	0 (0)	0 (0)	17 (18)	4 (25)	0 (0)	0 (0)	0 (0)	0 (0)	18
	cefoxitin	0 (0)	0 (0)	0 (0)	0 (0)	3 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2
	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	25 (68)	10 (100)	0 (0)	0 (0)	80 (87)	9 (56)	0 (0)	0 (0)	0 (0)	1 (100)	79
	streptomycin	6 (16)	1 (10)	0 (0)	0 (0)	13 (14)	3 (19)	0 (0)	0 (0)	0 (0)	0 (0)	15
trimethoprim-sulfamethoxazole	6 (16)	1 (10)	0 (0)	0 (0)	14 (15)	4 (25)	0 (0)	0 (0)	0 (0)	0 (0)	16	
<b>III</b>	chloramphenicol	6 (16)	1 (10)	0 (0)	0 (0)	15 (16)	3 (19)	0 (0)	0 (0)	0 (0)	0 (0)	16
	sulfisoxazole	6 (16)	1 (10)	0 (0)	0 (0)	14 (15)	4 (25)	0 (0)	0 (0)	0 (0)	0 (0)	16
	tetracycline	5 (14)	0 (0)	0 (0)	0 (0)	7 (8)	3 (19)	0 (0)	0 (0)	0 (0)	0 (0)	9
<b>IV</b>												

**Table 6. Individual antimicrobial drug resistance in human *Salmonella* Typhimurium isolates by province; *Surveillance of Human Clinical Isolates, 2006.***

	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada <sup>1</sup>
		N=54	N=60	N=21	N=34	N=218	N=96	N=27	N=8	N=10	N=2	%
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	%
<b>I</b>	amoxicillin-clavulanic acid	2 (4)	2 (3)	1 (5)	1 (3)	1 (0)	5 (5)	0 (0)	0 (0)	0 (0)	0 (0)	3
	ceftriaxone	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ceftiofur	0 (0)	2 (3)	0 (0)	0 (0)	1 (0)	5 (5)	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
<b>II</b>	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	22 (41)	20 (33)	3 (14)	8 (24)	63 (29)	41 (43)	0 (0)	2 (25)	1 (10)	0 (0)	33
	cefoxitin	1 (2)	2 (3)	0 (0)	0 (0)	1 (0)	5 (5)	0 (0)	0 (0)	0 (0)	0 (0)	2
	gentamicin	0 (0)	1 (2)	0 (0)	1 (3)	2 (1)	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)	1
	kanamycin	13 (24)	15 (25)	4 (19)	2 (6)	31 (14)	21 (22)	1 (4)	0 (0)	1 (10)	0 (0)	18
	nalidixic acid	3 (6)	1 (2)	0 (0)	0 (0)	3 (1)	1 (1)	1 (4)	0 (0)	0 (0)	0 (0)	2
	streptomycin	29 (54)	26 (43)	7 (33)	4 (12)	77 (35)	40 (42)	2 (7)	2 (25)	0 (0)	1 (50)	39
	trimethoprim-sulfamethoxazole	15 (28)	10 (17)	2 (10)	2 (6)	9 (4)	4 (4)	0 (0)	1 (13)	0 (0)	0 (0)	9
<b>III</b>	chloramphenicol	19 (35)	11 (18)	3 (14)	4 (12)	60 (28)	34 (35)	0 (0)	1 (13)	1 (10)	0 (0)	28
	sulfisoxazole	27 (50)	28 (47)	6 (29)	6 (18)	75 (34)	47 (49)	4 (15)	3 (38)	1 (10)	1 (50)	41
	tetracycline	28 (52)	23 (38)	6 (29)	9 (26)	75 (34)	48 (50)	3 (11)	2 (25)	1 (10)	1 (50)	41
<b>IV</b>												

<sup>1</sup> Estimated percentage for Canada corrected for non-proportional submission scheme between provinces (See Method section of previous CIPARS reports).

**Table 7. Individual antimicrobial drug resistance in “Other Serovars” of human *Salmonella* isolates by province; *Surveillance of Human Clinical Isolates, 2006.***

	Antimicrobial	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	Canada <sup>1</sup>
		N=125 n (%)	N=128 n (%)	N=61 n (%)	N=59 n (%)	N=508 n (%)	N=159 n (%)	N=44 n (%)	N=26 n (%)	N=6 n (%)	N=10 n (%)	%
<b>I</b>	amoxicillin-clavulanic acid	4 (3)	5 (4)	3 (5)	2 (3)	12 (2)	3 (2)	0 (0)	0 (0)	0 (0)	1 (10)	3
	ceftriaxone	0 (0)	2 (2)	0 (0)	1 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	<1
	ceftiofur	4 (3)	6 (5)	1 (2)	3 (5)	11 (2)	3 (2)	0 (0)	2 (8)	0 (0)	1 (10)	3
	ciprofloxacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (1)	0 (0)	0 (0)	0 (0)	0 (0)	<1
<b>II</b>	amikacin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	ampicillin	5 (4)	8 (6)	6 (10)	9 (15)	24 (5)	15 (9)	0 (0)	5 (19)	3 (50)	2 (20)	8
	cefoxitin	4 (3)	5 (4)	1 (2)	1 (2)	11 (2)	3 (2)	0 (0)	0 (0)	0 (0)	1 (10)	3
	gentamicin	2 (2)	1 (1)	1 (2)	2 (3)	3 (1)	5 (3)	0 (0)	2 (8)	0 (0)	1 (10)	2
	kanamycin	0 (0)	3 (2)	1 (2)	0 (0)	9 (2)	2 (1)	0 (0)	0 (0)	0 (0)	0 (0)	1
	nalidixic acid	12 (10)	3 (2)	1 (2)	0 (0)	27 (5)	9 (6)	1 (2)	1 (4)	0 (0)	2 (20)	5
	streptomycin	19 (15)	18 (14)	6 (10)	11 (19)	37 (7)	15 (9)	1 (2)	6 (23)	2 (33)	1 (10)	11
trimethoprim-sulfamethoxazole	8 (6)	5 (4)	0 (0)	2 (3)	23 (5)	3 (2)	3 (7)	1 (4)	0 (0)	0 (0)	4	
<b>III</b>	chloramphenicol	3 (2)	7 (5)	7 (11)	5 (8)	7 (1)	7 (4)	3 (7)	5 (19)	0 (0)	0 (0)	4
	sulfisoxazole	15 (12)	12 (9)	10 (16)	9 (15)	38 (7)	18 (11)	5 (11)	5 (19)	3 (50)	2 (20)	11
	tetracycline	29 (23)	25 (20)	12 (20)	10 (17)	50 (10)	29 (18)	6 (14)	8 (31)	2 (33)	2 (20)	17
<b>IV</b>												

<sup>1</sup> Estimated percentage for Canada corrected for non-proportional submission scheme between provinces (See Method section of previous CIPARS reports).

**Table 8. Number of antimicrobials in resistance pattern of human *Salmonella* isolates across provinces and serovars; *Surveillance of Human Clinical Isolates, 2006.***

Serovar <sup>1</sup>	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
Number of isolates					
<b>British Columbia</b>					
Enteritidis	62 (18.2)	45	16	1	0
Typhimurium	54 (15.9)	22	11	20	1
Typhi	37 (10.9)	12	19	6	0
Heidelberg	26 (7.6)	12	11	3	0
Newport	18 (5.3)	10	3	3	2
Paratyphi A	17 (5)	0	17	0	0
Hadar	13 (3.8)	0	13	0	0
Paratyphi B var. L (+) tartrate+	10 (2.9)	9	1	0	0
Stanley	10 (2.9)	5	4	1	0
Infantis	8 (2.4)	6	2	0	0
Less frequent serovars	85 (25)	68	12	5	0
<b>Total</b>	<b>340</b>	<b>189</b>	<b>109</b>	<b>39</b>	<b>3</b>
<b>Alberta</b>					
Enteritidis	101 (27.4)	78	23	0	0
Typhimurium	60 (16.3)	26	19	14	1
Heidelberg	46 (12.5)	14	32	0	0
Hadar	18 (4.9)	10	8	0	0
Newport	15 (4.1)	13	1	1	0
Typhi	10 (2.7)	0	9	1	0
Less frequent serovars	118 (32.1)	88	25	3	2
<b>Total</b>	<b>368</b>	<b>229</b>	<b>117</b>	<b>19</b>	<b>3</b>
<b>Saskatchewan</b>					
Enteritidis	34 (25.8)	24	10	0	0
Typhimurium	21 (15.9)	13	6	2	0
Heidelberg	14 (10.6)	5	9	0	0
I 4,5,12:i:-	7 (5.3)	4	1	2	0
Paratyphi B var. L (+) tartrate+	7 (5.3)	7	0	0	0
Thompson	7 (5.3)	4	3	0	0
Javiana	5 (3.8)	5	0	0	0
Agona	3 (2.3)	2	1	0	0
Hadar	3 (2.3)	0	3	0	0
Infantis	3 (2.3)	3	0	0	0
Less frequent serovars	28 (21.2)	24	3	1	0
<b>Total</b>	<b>132</b>	<b>91</b>	<b>36</b>	<b>5</b>	<b>0</b>
<b>Manitoba</b>					
Enteritidis	35 (22.6)	25	10	0	0
Typhimurium	34 (21.9)	22	8	4	0
Heidelberg	21 (13.5)	3	17	1	0
Anatum	5 (3.2)	4	1	0	0
Newport	5 (3.2)	3	0	2	0
Muenchen	4 (2.6)	4	0	0	0
Poona	4 (2.6)	4	0	0	0
Stanley	4 (2.6)	2	1	1	0
Thompson	4 (2.6)	4	0	0	0
Less frequent serovars	39 (25.2)	28	7	4	0
<b>Total</b>	<b>155</b>	<b>99</b>	<b>44</b>	<b>12</b>	<b>0</b>



Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
Number of isolates					
<b>Ontario</b>					
Enteritidis	298 (22)	233	63	2	0
Typhimurium	218 (16.1)	134	22	62	0
Heidelberg	123 (9.1)	59	59	5	0
Typhi	92 (6.8)	10	67	15	0
Newport	85 (6.3)	70	11	2	2
Thompson	58 (4.3)	55	3	0	0
Paratyphi A	32 (2.4)	2	30	0	0
Less frequent serovars	451 (33.2)	369	69	13	0
<b>Total</b>	<b>1357</b>	<b>932</b>	<b>324</b>	<b>99</b>	<b>2</b>
<b>Quebec</b>					
Heidelberg	96 (20)	48	47	0	1
Typhimurium	96 (20)	34	28	34	0
Enteritidis	89 (18.6)	73	16	0	0
Saintpaul	35 (7.3)	32	3	0	0
Newport	16 (3.3)	12	2	0	2
Typhi	16 (3.3)	5	8	3	0
Thompson	11 (2.3)	10	1	0	0
Less frequent serovars	120 (25.1)	89	17	13	1
<b>Total</b>	<b>479</b>	<b>303</b>	<b>122</b>	<b>50</b>	<b>4</b>
<b>New Brunswick</b>					
Heidelberg	71 (39.9)	47	18	5	1
Enteritidis	35 (19.7)	26	9	0	0
Typhimurium	27 (15.2)	21	6	0	0
I 4,5,12:i:-	5 (2.8)	4	1	0	0
Poona	5 (2.8)	5	0	0	0
Saintpaul	5 (2.8)	5	0	0	0
Schwarzengrund	4 (2.2)	3	1	0	0
Thompson	4 (2.2)	4	0	0	0
Less frequent serovars	22 (12.4)	17	4	1	0
<b>Total</b>	<b>178</b>	<b>132</b>	<b>39</b>	<b>6</b>	<b>1</b>
<b>Nova Scotia</b>					
Enteritidis	33 (38.8)	19	14	0	0
Heidelberg	16 (18.8)	9	6	1	0
Typhimurium	8 (9.4)	3	4	1	0
Paratyphi B var. L (+) tartrate +	3 (3.5)	0	0	3	0
Bareilly	2 (2.4)	2	0	0	0
Concord	2 (2.4)	0	0	2	0
Kiambu	2 (2.4)	0	2	0	0
Newport	2 (2.4)	2	0	0	0
Saintpaul	2 (2.4)	2	0	0	0
Stanley	2 (2.4)	2	0	0	0
Less frequent serovars	13 (15.3)	11	2	0	0
<b>Total</b>	<b>85</b>	<b>50</b>	<b>28</b>	<b>7</b>	<b>0</b>

Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
Number of isolates					
<b>Prince Edward Island</b>					
Typhimurium	10 (33.3)	9	0	1	0
Enteritidis	8 (26.7)	6	2	0	0
Heidelberg	6 (20)	3	3	0	0
I 4,12:i:-	2 (6.7)	1	1	0	0
I 4,5,12:i:-	1 (3.3)	0	1	0	0
Infantis	1 (3.3)	0	1	0	0
Manhattan	1 (3.3)	1	0	0	0
Paratyphi B var. L (+) tartrate +	1 (3.3)	1	0	0	0
<b>Total</b>	<b>30</b>	<b>21</b>	<b>8</b>	<b>1</b>	<b>0</b>
<b>Newfoundland and Labrador</b>					
Heidelberg	7 (25.9)	1	6	0	0
Enteritidis	6 (22.2)	5	1	0	0
Agona	5 (18.5)	4	0	1	0
Typhimurium	2 (7.4)	1	1	0	0
Aberdeen	1 (3.7)	0	1	0	0
Bredeney	1 (3.7)	1	0	0	0
Hadar	1 (3.7)	0	0	1	0
Newport	1 (3.7)	1	0	0	0
Saintpaul	1 (3.7)	0	1	0	0
Sandiego	1 (3.7)	1	0	0	0
Typhi	1 (3.7)	0	1	0	0
<b>Total</b>	<b>27</b>	<b>14</b>	<b>11</b>	<b>2</b>	<b>0</b>
<b>Nunavut</b>					
Heidelberg	1 (100)	0	1	0	0
<b>Total</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>
<b>Canada Total</b>	<b>3152</b>	<b>2060</b>	<b>839</b>	<b>240</b>	<b>13</b>

<sup>1</sup> Serovars with less than 2% prevalence are categorized as "Less frequent serovars". This category may include *S. Typhi*, *S. Paratyphi A* or *B* and, *S. Newport* if they represent less than 2% of all isolates received from a given province.

**Table 9. Details regarding age and province distribution of human *Salmonella* isolates; Surveillance of Human Clinical Isolates, 2006.**

Age distribution n/N (%)	Province n/N (%)
Less than 5 years: 420/3152 (13%)	Alberta: 368/3152 (12%)
5 to 12 years: 320/3152 (10%)	British Columbia: 340/3152 (11%)
13 to 17 years: 148/3152 (5%)	Manitoba: 155/3152 (5%)
18 to 29 years: 571/3152 (18%)	New Brunswick: 178/3152 (6%)
30 to 49 years: 683/3152 (22%)	Newfoundland and Labrador: 27/3152 (<1%)
50 to 69 years: 511/3152 (16%)	Nova Scotia: 85/3152 (3%)
70+ years: 227/3152 (7%)	Nunavut: 1/3152 (<1%)
N/A: 272/3152 (9%)	Ontario: 1357/3152 (43%)
	Prince Edward Island: 30/3152 (<1%)
	Québec: 479/3152 (15%)
	Saskatchewan: 132/3152 (4%)

**Table 10. Details regarding specimen source of the primary human *Salmonella* serovars; Surveillance of Human Clinical Isolates, 2006.**

Specimen Source	Enteritidis N=701 n (%)	Heidelberg N=427 n (%)	Newport N=144 n (%)	Paratyphi A and B N=66 n (%)	Typhi N=158 n (%)	Typhimurium N=530 n (%)	Other serovars N=1126 n (%)	Total N=3152 n (%)
Stool	542 (77)	306 (72)	96 (67)	9 (14)	35 (22)	407 (77)	805 (71)	2200 (70)
Blood	19 (3)	34 (8)	5 (3)	34 (51)	80 (51)	9 (2)	33 (3)	214 (7)
Urine	13 (2)	16 (4)	11 (8)			9 (2)	54 (5)	103 (3)
Abscess					2 (1)	1 (<1)		3 (<1)
Anatomy							1 (<1)	1 (<1)
Fluid							1 (<1)	1 (<1)
Sputum							1 (<1)	1 (<1)
Unknown	127 (18)	71 (17)	32 (22)	23 (35)	41 (26)	104 (20)	231 (21)	629 (20)

# Chickens

**Table 11. Recovery rate and final number of isolates submitted for antimicrobial susceptibility testing in **chicken** across surveillance components and bacterial species; 2002-2006.**

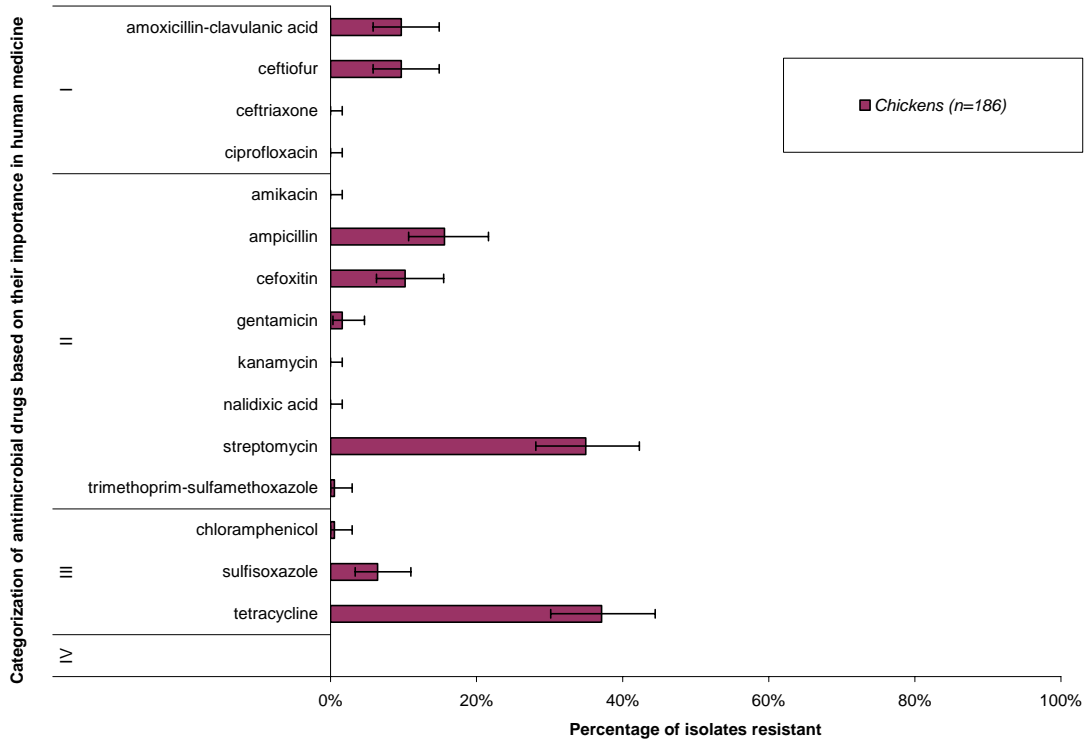
Province	Species	2002		2003		2004		2005		2006	
		Recovery Rate	n	Recovery Rate	n	Recovery Rate	n	Recovery Rate	n	Recovery Rate	n
<b>Abattoir Surveillance</b>											
All	<i>E.coli</i>	100%	40	97%	150	99%	130	99%	218	100%	166
	<i>Salmonella</i>	13%	25	16%	126	16%	142	18%	199	27%	186
<b>Retail Meat Surveillance</b>											
Ontario	<i>E.coli</i>			95%	136	95%	150	95%	145	97%	152
	<i>Salmonella</i>			16%	26	17%	55	9%	26	12%	36
	<i>Campylobacter</i>			47%	78	45%	140	40%	120	34%	104
	<i>Enterococcus</i>					100%	158	99%	150		
Québec	<i>E.coli</i>			89%	112	98%	158	95%	142	94%	135
	<i>Salmonella</i>			16%	28	17%	52	9%	26	12%	33
	<i>Campylobacter</i>			55%	94	50%	158	34%	103	36%	100
	<i>Enterococcus</i>					100%	162	100%	150		
Saskatchewan	<i>E.coli</i>							96%	81	98%	85
	<i>Salmonella</i>							14%	21	16%	25
	<i>Campylobacter</i>							37%	52	33%	51
	<i>Enterococcus</i>							98%	80		

Note: Shaded areas represent microorganisms and commodities where no antimicrobial resistance results were presented for the Abattoir and Retail Meat surveillance components

# Antimicrobial Resistance in *Salmonella*

## Abattoir Surveillance

Figure 1. Individual antimicrobial drug resistance in **chicken *Salmonella*** isolates; **Abattoir Surveillance, 2006.**



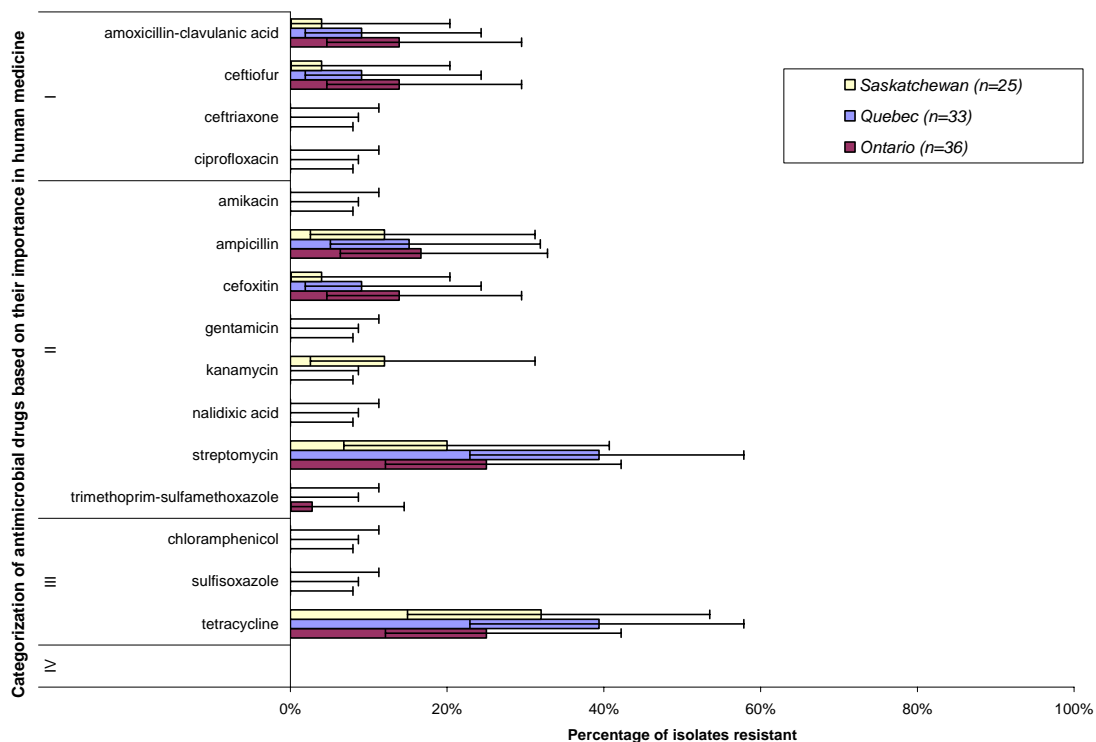
**Table 12. Number of antimicrobials in resistance pattern of chicken *Salmonella* isolates across serovars; *Abattoir Surveillance*, 2006.**

Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
		<b>Number of isolates</b>			
Kentucky	80 (43)	26	51	3	0
Heidelberg	38 (20.4)	19	18	1	0
Enteritidis	14 (7.5)	14	0	0	0
Hadar	7 (3.8)	0	7	0	0
Typhimurium	7 (3.8)	6	1	0	0
I 4:i:-	6 (3.2)	4	2	0	0
Agona	5 (2.7)	2	3	0	0
Schwarzengrund	5 (2.7)	0	5	0	0
Kiambu	4 (2.2)	3	1	0	0
Senftenberg	4 (2.2)	4	0	0	0
Less frequent serovars <sup>1</sup>	16 (8.6)	9	7	0	0
<b>Total</b>	<b>186</b>	<b>87</b>	<b>95</b>	<b>4</b>	<b>0</b>

<sup>1</sup> Serovars with less than 2% prevalence are classified in this category .

**Retail Meat Surveillance**

**Figure 2. Individual antimicrobial drug resistance in chicken *Salmonella* isolates from Saskatchewan, Ontario and, Québec; *Retail Meat Surveillance*, 2006.**

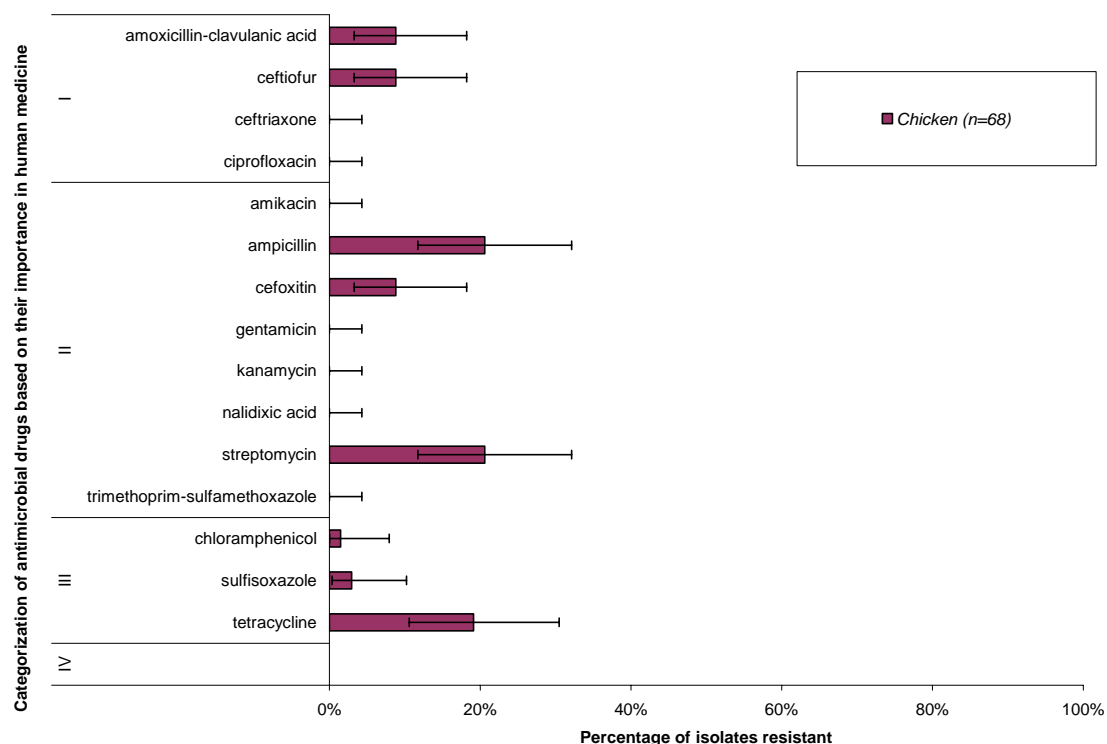


**Table 13. Number of antimicrobials in resistance pattern of chicken *Salmonella* isolates from Saskatchewan, Ontario, and Québec across serotypes; *Retail Meat Surveillance*, 2006.**

Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
<b>Number of isolates</b>					
<b>Saskatchewan</b>					
Heidelberg	8 (32)	5	2	1	0
Enteritidis	5 (20)	5	0	0	0
Hadar	5 (20)	0	5	0	0
Kiambu	3 (12)	2	1	0	0
I 4:i:-	1 (4)	0	1	0	0
Infantis	1 (4)	1	0	0	0
Kentucky	1 (4)	0	1	0	0
Thompson	1 (4)	1	0	0	0
<b>Total</b>	<b>25</b>	<b>14</b>	<b>10</b>	<b>1</b>	<b>0</b>
<b>Ontario</b>					
Heidelberg	14 (38.9)	10	4	0	0
Kentucky	8 (22.2)	2	5	1	0
Enteritidis	3 (8.3)	3	0	0	0
Indiana	3 (8.3)	2	1	0	0
Albert	1 (2.8)	0	1	0	0
I 6,8:-:x	1 (2.8)	0	1	0	0
I 8,20:i:-	1 (2.8)	0	1	0	0
Kiambu	1 (2.8)	1	0	0	0
Putten	1 (2.8)	0	1	0	0
Thompson	1 (2.8)	1	0	0	0
Typhimurium	1 (2.8)	1	0	0	0
Typhimurium var. 5-	1 (2.8)	1	0	0	0
<b>Total</b>	<b>36</b>	<b>21</b>	<b>14</b>	<b>1</b>	<b>0</b>
<b>Québec</b>					
Heidelberg	14 (42.4)	10	4	0	0
Kentucky	12 (36.4)	2	10	0	0
Enteritidis	2 (6.1)	2	0	0	0
Typhimurium var. 5-	2 (6.1)	0	2	0	0
Hadar	1 (3)	0	1	0	0
I 8,20:i:-	1 (3)	0	1	0	0
Thompson	1 (3)	1	0	0	0
<b>Total</b>	<b>33</b>	<b>15</b>	<b>18</b>	<b>0</b>	<b>0</b>
<b>Grand Total</b>	<b>94</b>	<b>50</b>	<b>42</b>	<b>2</b>	<b>0</b>

## Surveillance of Animal Clinical Isolates

**Figure 3. Individual antimicrobial drug resistance in chicken *Salmonella* isolates; Surveillance of Animal Clinical Isolates, 2006.**



**Table 14. Number of antimicrobials in resistance pattern of chicken *Salmonella* isolates across serovars; Surveillance of Animal Clinical Isolates, 2006.**

Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
<b>Number of isolates</b>					
Heidelberg	27 (39.7)	17	8	2	0
Enteritidis	22 (32.4)	22	0	0	0
Kentucky	7 (10.3)	0	7	0	0
I 4:-:-	2 (2.9)	0	2	0	0
Montevideo	2 (2.9)	2	0	0	0
Typhimurium	2 (2.9)	1	0	1	0
Less frequent serovars <sup>1</sup>	6 (8.8)	4	2	0	0
<b>Total</b>	<b>68</b>	<b>46</b>	<b>19</b>	<b>3</b>	<b>0</b>

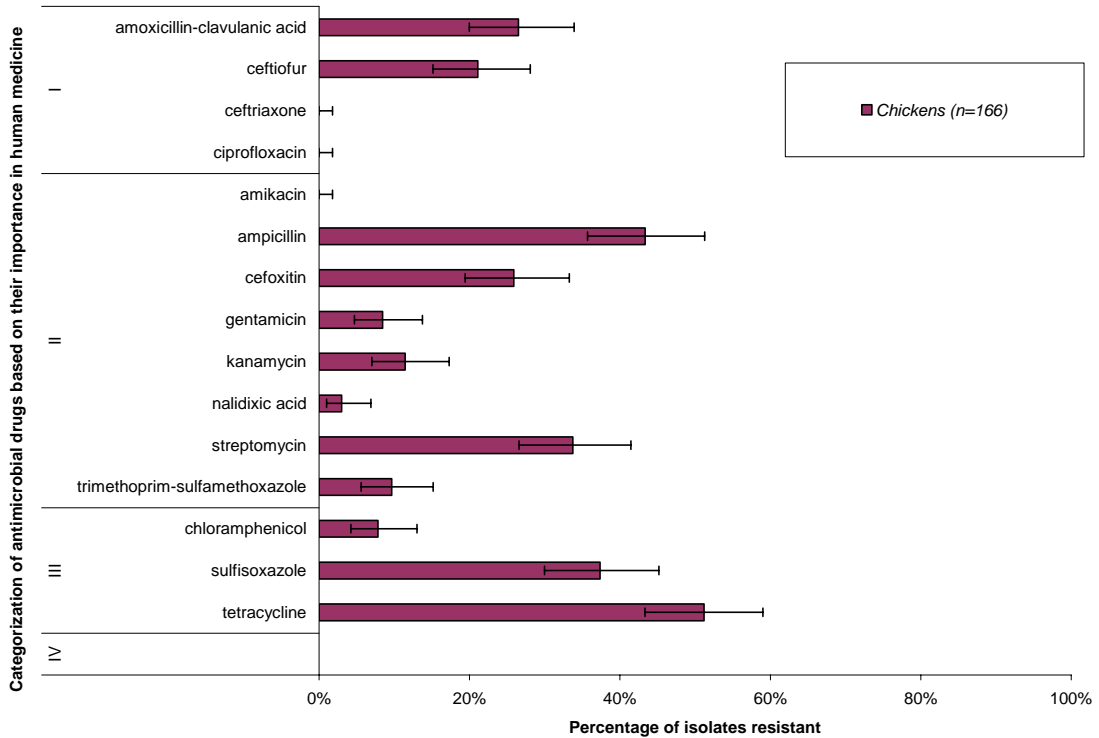
<sup>1</sup> Serovars with less than 2% prevalence are classified in this category .



# Antimicrobial Resistance in *Escherichia coli*

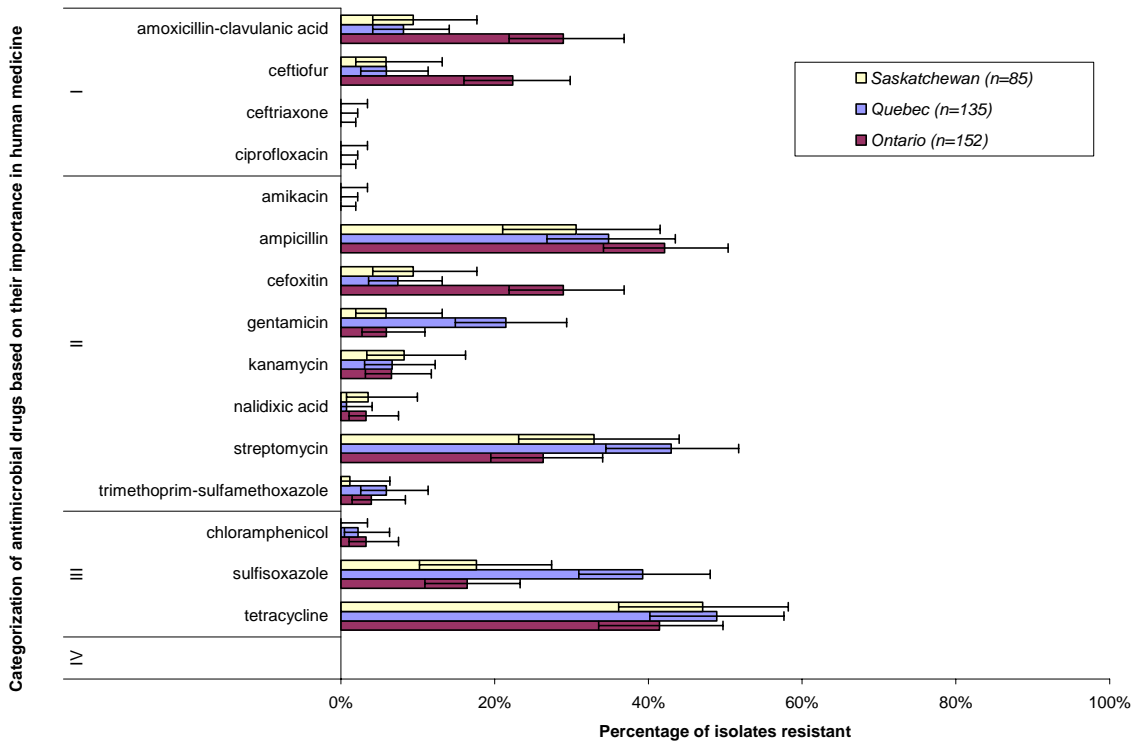
## Abattoir Surveillance

Figure 4. Individual antimicrobial drug resistance in **chicken** *E. coli* isolates; **Abattoir Surveillance, 2006.**



**Retail Meat Surveillance**

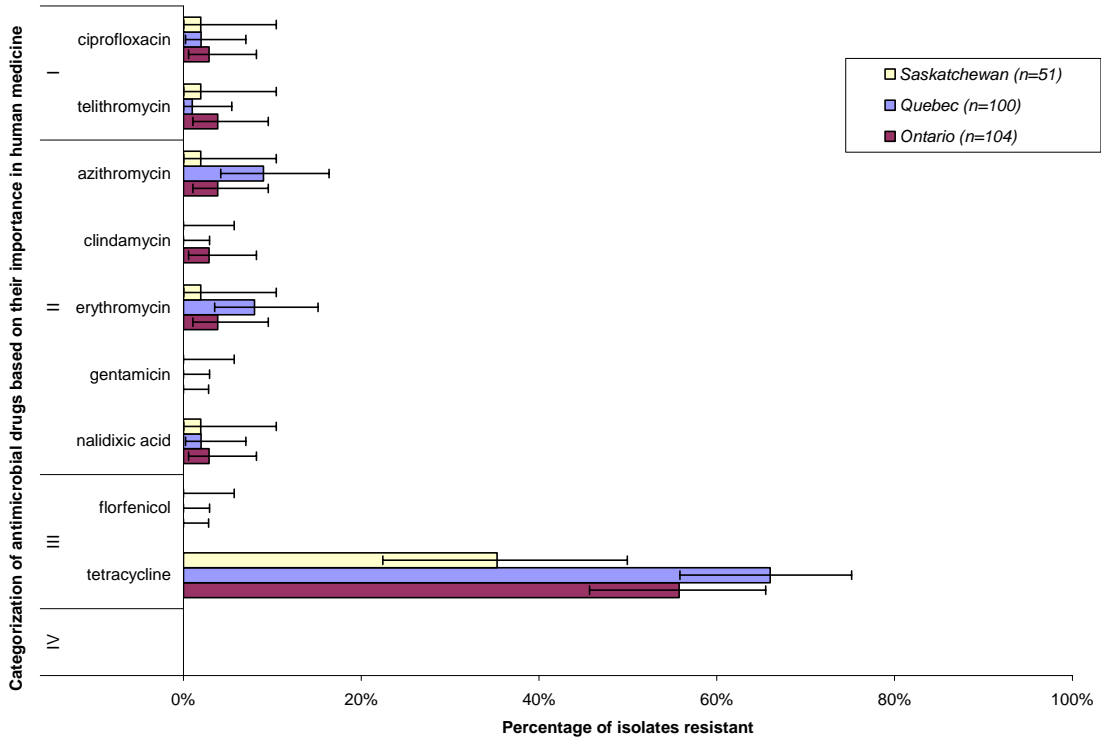
**Figure 5. Individual antimicrobial drug resistance in chicken *E. coli* isolates from Saskatchewan, Ontario and, Québec; *Retail Meat Surveillance, 2006.***



# Antimicrobial Resistance in *Campylobacter*

## Retail Meat Surveillance

**Figure 6. Individual antimicrobial drug resistance in *chicken Campylobacter* isolates from Saskatchewan, Ontario and, Québec; *Retail Meat Surveillance*, 2006.**

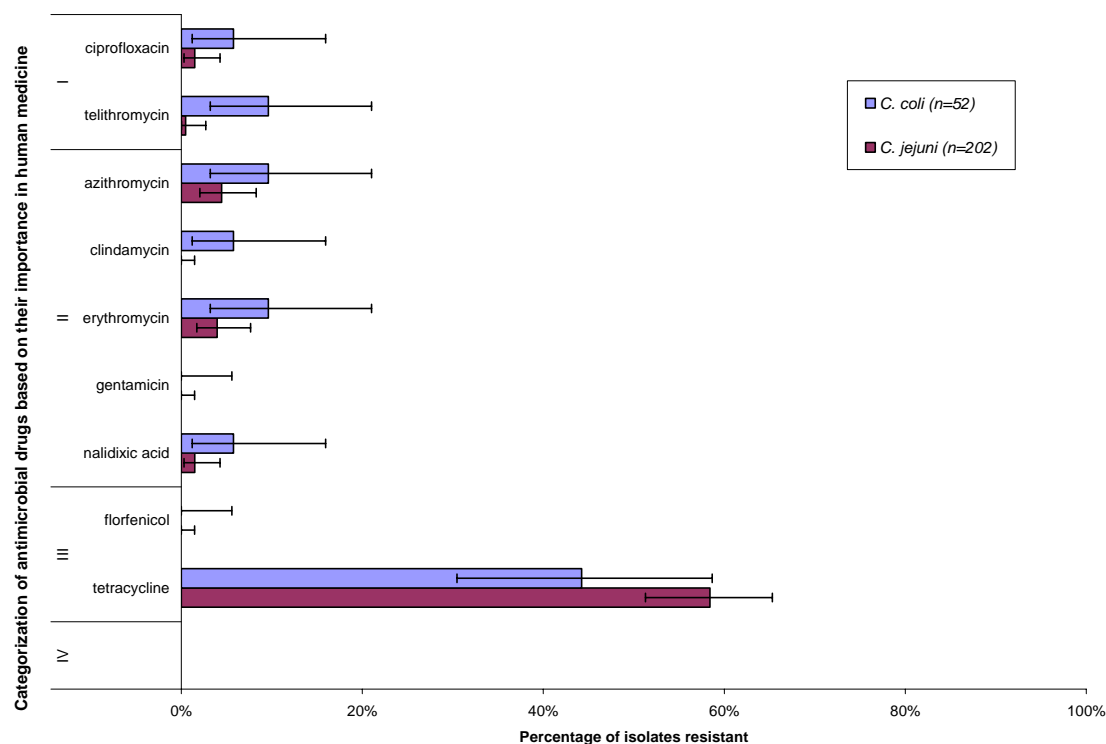


**Table 15. Number of antimicrobials in resistance pattern of chicken *Campylobacter* isolates across species; Retail Meat Surveillance, 2006.**

Species <sup>1</sup>	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-2	3-4	5-9
Number of isolates					
<b>Saskatchewan</b>					
<i>C. jejuni</i>	40 (78.4)	23	17	0	0
<i>C. coli</i>	11 (21.6)	10	1	0	0
<b>Total</b>	<b>51</b>	<b>33</b>	<b>18</b>	<b>0</b>	<b>0</b>
<b>Ontario</b>					
<i>C. jejuni</i>	87 (83.7)	36	51	0	0
<i>C. coli</i>	17 (16.3)	8	7	2	0
<b>Total</b>	<b>104</b>	<b>44</b>	<b>58</b>	<b>2</b>	<b>0</b>
<b>Québec</b>					
<i>C. jejuni</i>	75 (75)	24	51	0	0
<i>C. coli</i>	24 (24)	9	15	0	0
<i>Campylobacter</i> spp.	1 (1)	0	1	0	0
<b>Total</b>	<b>100</b>	<b>33</b>	<b>67</b>	<b>0</b>	<b>0</b>
<b>Grand Total</b>	<b>255</b>	<b>110</b>	<b>143</b>	<b>2</b>	<b>0</b>

<sup>1</sup> The *Campylobacter* isolates were speciated using biochemical tests. PCR information was not available at the time of data analysis.

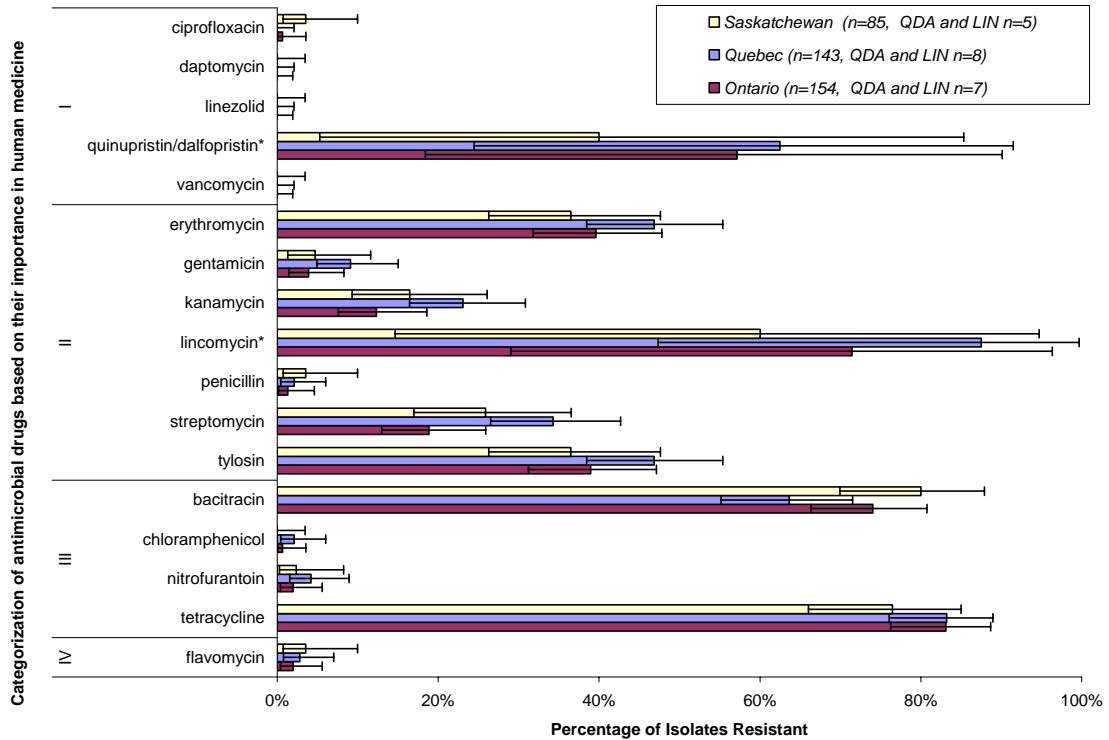
**Figure 7. Individual antimicrobial drug resistance in chicken *Campylobacter* isolates across species; Retail Meat Surveillance, 2006.**



# Antimicrobial Resistance in *Enterococcus*

## Retail Meat Surveillance

**Figure 8. Individual antimicrobial drug resistance in chicken *Enterococcus* isolates from Saskatchewan, Ontario, and Québec; Retail Meat Surveillance, 2006.**



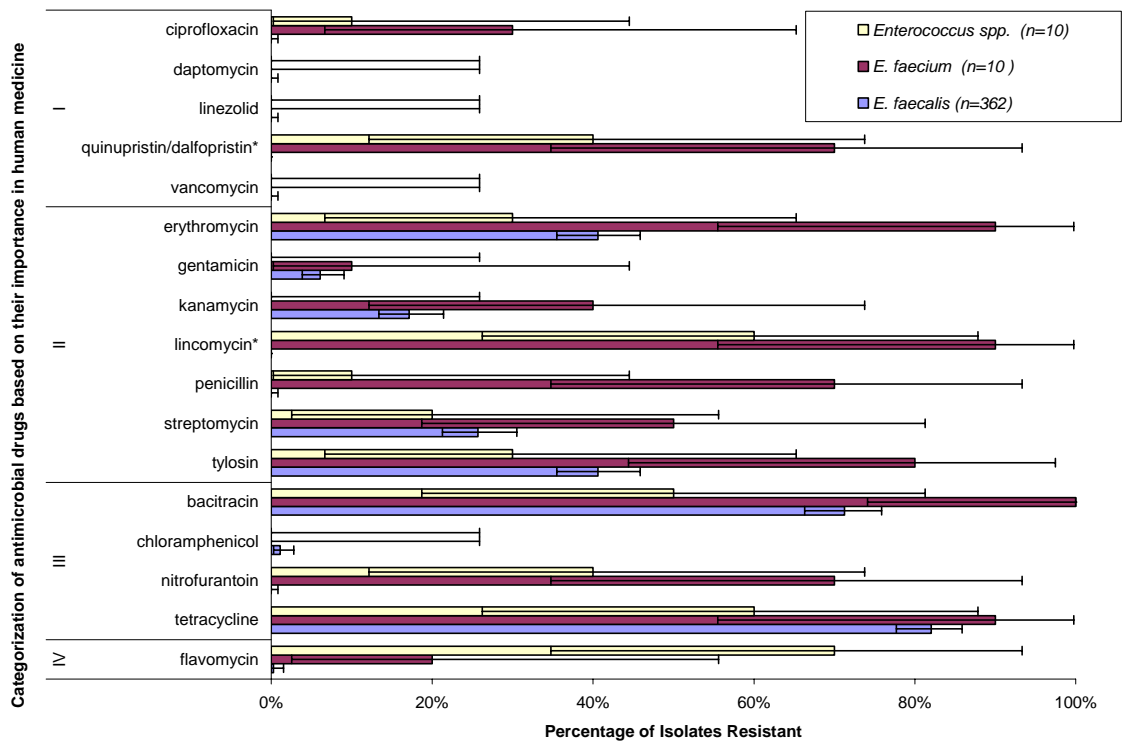
Note: Resistance to quinupristin-dalfopristin (QDA) and lincomycin (LIN) is not reported for *E. faecalis* because of its intrinsic resistance for these antimicrobials.

**Table 16. Number of antimicrobials in resistance pattern of chicken *Enterococcus* isolates across species; Retail Meat Surveillance, 2006.**

Species	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
<b>Number of isolates</b>					
<b>Saskatchewan</b>					
<i>E. faecalis</i>	80 (94.1)	6	56	18	0
<i>Enterococcus spp.</i>	3 (3.5)	0	2	1	0
<i>E. faecium</i>	2 (2.4)	0	0	1	1
<b>Total</b>	<b>85</b>	<b>6</b>	<b>58</b>	<b>20</b>	<b>1</b>
<b>Ontario</b>					
<i>E. faecalis</i>	147 (95.5)	7	118	22	0
<i>E. faecium</i>	4 (2.6)	0	1	1	2
<i>Enterococcus spp.</i>	3 (1.9)	0	1	2	0
<b>Total</b>	<b>154</b>	<b>7</b>	<b>120</b>	<b>25</b>	<b>2</b>
<b>Québec</b>					
<i>E. faecalis</i>	136 (94.4)	11	90	34	0
<i>E. faecium</i>	4 (2.8)	0	0	1	3
<i>Enterococcus spp.</i>	4 (2.8)	0	2	2	0
<b>Total</b>	<b>143</b>	<b>11</b>	<b>92</b>	<b>37</b>	<b>3</b>
<b>Grand Total</b>	<b>382</b>	<b>24</b>	<b>270</b>	<b>82</b>	<b>6</b>

<sup>1</sup> *Enterococcus* isolates were speciated using biochemical tests. PCR information was not available at the time of data analysis.

Figure 9. Individual antimicrobial drug resistance in **chicken *Enterococcus*** isolates across species; *Retail Meat Surveillance, 2006*.



# Swine

**Table 17. Recovery rate and final number of isolates submitted for antimicrobial sensitivity testing in swine across surveillance components and bacterial species; 2002-2006.**

Province	Species	2002	2003		2004	2005		2006			
		Recovery Rate	n	Recovery Rate	n	Recovery Rate	n	Recovery Rate	n		
<b>Abattoir Surveillance</b>											
All	<i>E.coli</i>	97%	38	98%	155	99%	142	99%	162	98%	115
	<i>Salmonella</i>	27%	101	28%	395	38%	270	42%	211	40%	144
<b>Retail Meat Surveillance</b>											
Ontario	<i>E.coli</i>			58%	91	71%	198	59%	179	60%	182
	<i>Salmonella</i>			1%						< 1%	
	<i>Campylobacter</i>			0%							
	<i>Enterococcus</i>			87%	66						
Québec	<i>E.coli</i>			42%	61	38%	108	26%	78	21%	57
	<i>Salmonella</i>			3%						0%	
	<i>Campylobacter</i>			9%							
	<i>Enterococcus</i>			82%	28						
Saskatchewan	<i>E.coli</i>							30%	48	31%	49
	<i>Salmonella</i>									2%	

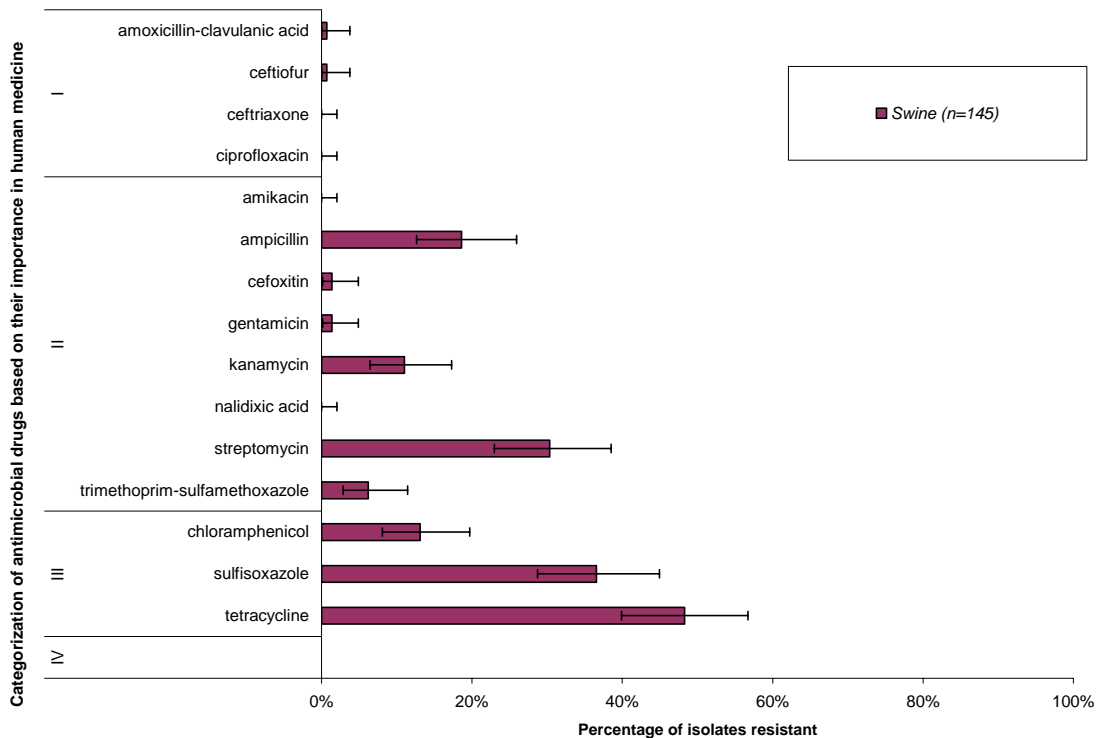
Note: Shaded areas represent microorganisms and commodities where no antimicrobial resistance results were presented for the Abattoir and Retail Meat surveillance components.



# Antimicrobial Resistance in *Salmonella*

## Abattoir Surveillance

**Figure 10. Individual antimicrobial drug resistance in *swine Salmonella* isolates; *Abattoir Surveillance*, 2006.**



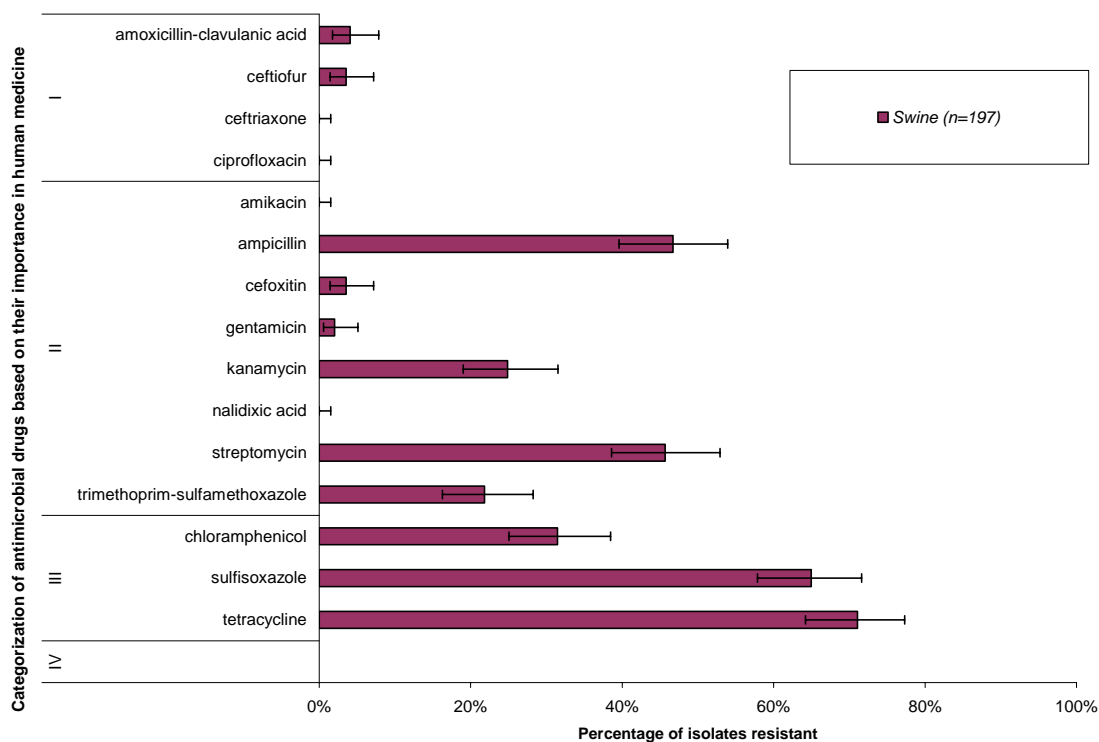
**Table 18. Number of antimicrobials in resistance pattern of swine *Salmonella* isolates across serovars; *Abattoir Surveillance*, 2006.**

Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
		<b>Number of isolates</b>			
Derby	38 (26.2)	8	28	2	0
Typhimurium var. 5-	21 (14.5)	5	7	9	0
Typhimurium	18 (12.4)	4	7	7	0
Infantis	7 (4.8)	6	1	0	0
Agona	6 (4.1)	4	2	0	0
Heidelberg	6 (4.1)	1	5	0	0
Livingstone	6 (4.1)	6	0	0	0
Schwarzengrund	6 (4.1)	5	1	0	0
Brandenburg	5 (3.4)	4	1	0	0
Berta	3 (2.1)	2	1	0	0
California	3 (2.1)	0	1	2	0
Give	3 (2.1)	3	0	0	0
Mbandaka	3 (2.1)	1	0	2	0
Less frequent serovars <sup>1</sup>	20 (13.8)	14	5	1	0
<b>Total</b>	<b>145</b>	<b>63</b>	<b>59</b>	<b>23</b>	<b>0</b>

<sup>1</sup> Serovars with less than 2% prevalence are classified in this category.

## Surveillance of Animal Clinical Isolates

**Figure 11. Individual antimicrobial drug resistance in swine *Salmonella* isolates; Surveillance of Animal Clinical Isolates, 2006.**



**Table 19. Number of antimicrobials in resistance pattern of swine *Salmonella* isolates across serovars; Surveillance of Animal Clinical Isolates, 2006.**

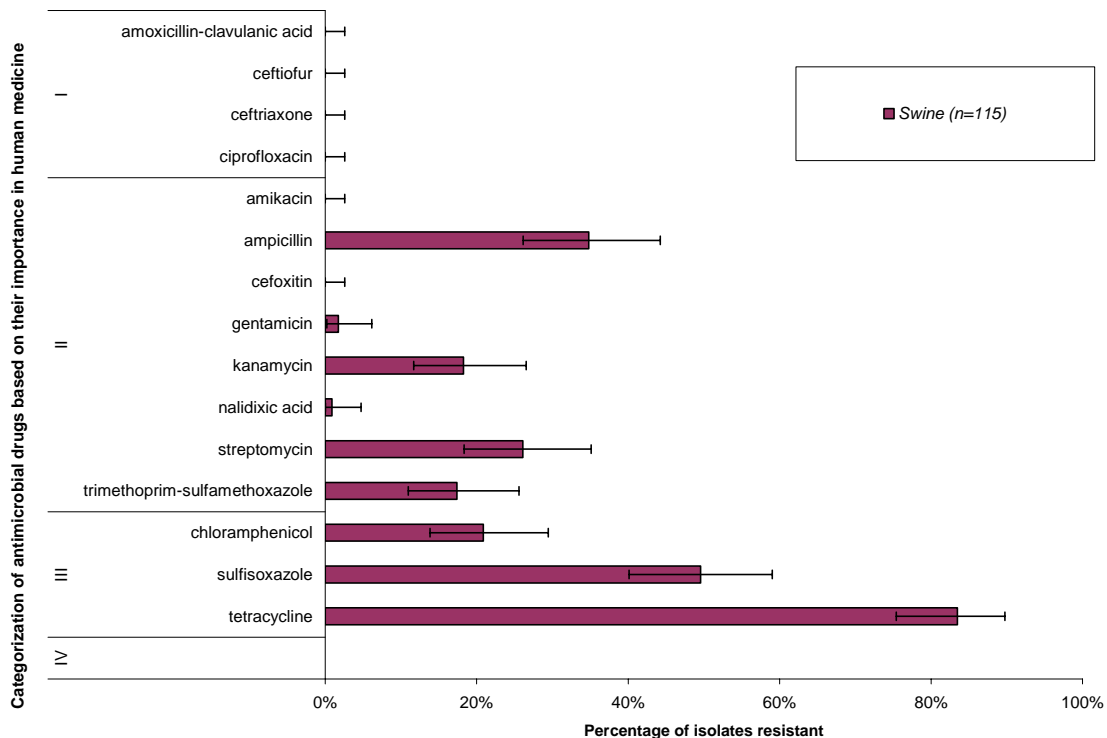
Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
Number of isolates					
Typhimurium	95 (48.2)	14	29	50	2
Typhimurium var. 5-Derby	24 (12.2)	2	12	10	0
Infantis	9 (4.6)	7	1	1	0
I 4:i:-	6 (3)	3	0	3	0
Schwarzengrund	6 (3)	2	4	0	0
Brandenburg	4 (2)	3	1	0	0
Less frequent serovars <sup>1</sup>	34 (17.3)	15	13	6	0
<b>Total</b>	<b>197</b>	<b>47</b>	<b>76</b>	<b>72</b>	<b>2</b>

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

# Antimicrobial Resistance in *Escherichia coli*

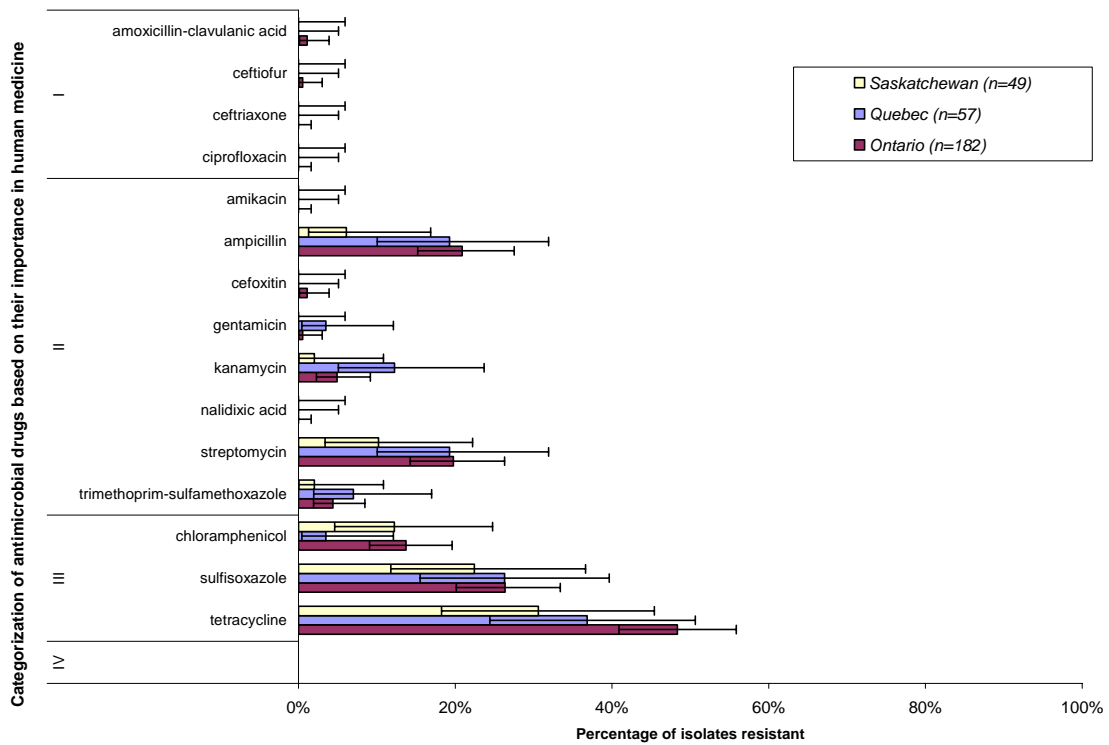
## Abattoir Surveillance

Figure 12. Individual antimicrobial drug resistance in *swine E. coli* isolates; *Abattoir Surveillance, 2006*.



**Retail Meat Surveillance**

**Figure 13. Individual antimicrobial drug resistance in pork *E. coli* isolates from Saskatchewan, Ontario, and Québec; Retail Meat Surveillance, 2006.**



# Bovine

**Table 20. Recovery rate and final number of isolates submitted for antimicrobial resistance testing in **bovine** across surveillance components and bacterial species; 2002-2006.**

Province	Species	2002		2003		2004		2005		2006	
		Recovery Rate	n	Recovery Rate	N	Recovery Rate	n	Recovery Rate	n	Recovery Rate	n
<b>Abattoir Surveillance</b>											
All	<i>E.coli</i>	97%	76 <sup>1</sup>	97%	155 <sup>2</sup>	98%	167	97%	122	94%	150
	<i>Salmonella</i>	1%	1	<1%							
	<i>Campylobacter</i>									30%	24
<b>Retail Meat Surveillance</b>											
Ontario	<i>E.coli</i>			66%	100	80%	190	81%	184	81%	189
	<i>Salmonella</i>			2%							
	<i>Campylobacter</i>			3%							
	<i>Enterococcus</i>			91%	69						
Québec	<i>E.coli</i>			57%	84	56%	137	56%	126	53%	109
	<i>Salmonella</i>			0%							
	<i>Campylobacter</i>			0%							
	<i>Enterococcus</i>			80%	28						
Saskatchewan	<i>E.coli</i>							79%	119	77%	123

Note: Shaded areas represent microorganisms and commodities where no antimicrobial resistance results were presented.

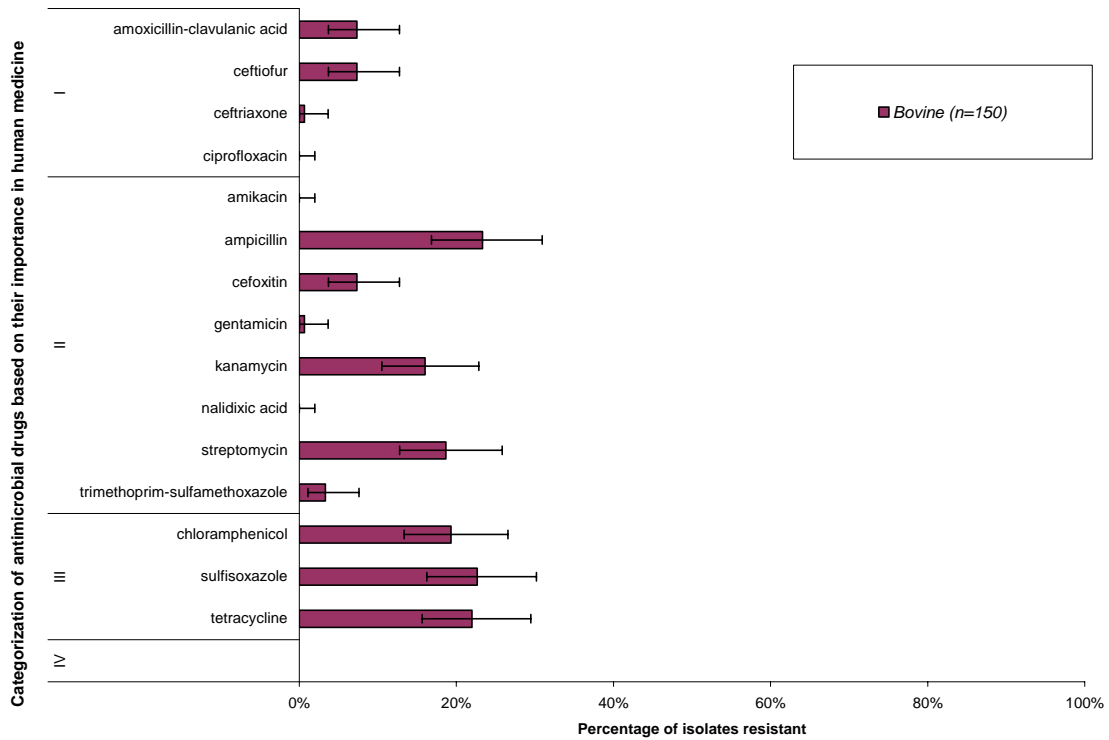
<sup>1</sup> Revised value for the number of *E.coli* beef cattle isolates submitted for AMR testing in 2002.

<sup>2</sup> Revised value for the number of *E.coli* beef cattle isolates submitted for AMR testing in 2003.

# Antimicrobial Resistance in *Salmonella*

## Surveillance of Animal Clinical Isolates

**Figure 14. Individual antimicrobial drug resistance in bovine *Salmonella* isolates; Surveillance of Animal Clinical Isolates, 2006.**



**Table 21. Number of antimicrobials in resistance pattern of bovine *Salmonella* isolates across serovars; *Surveillance of Animal Clinical Isolates*, 2006.**

Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
		<b>Number of isolates</b>			
Typhimurium	33 (22)	16	5	11	1
Kentucky	25 (16.7)	23	2	0	0
I 6,14,18:-:-	14 (9.3)	14	0	0	0
Typhimurium var. 5-	9 (6)	1	0	8	0
Heidelberg	7 (4.7)	3	3	1	0
Muenchen	7 (4.7)	6	0	0	1
Infantis	6 (4)	6	0	0	0
Thompson	6 (4)	6	0	0	0
Newport	5 (3.3)	1	0	0	4
Agona	4 (2.7)	2	0	0	2
Cerro	3 (2)	3	0	0	0
Muenster	3 (2)	3	0	0	0
Orion	3 (2)	3	0	0	0
Less frequent serovars <sup>1</sup>	25 (16.7)	23	1	0	1
<b>Total</b>	<b>150</b>	<b>110</b>	<b>11</b>	<b>20</b>	<b>9</b>

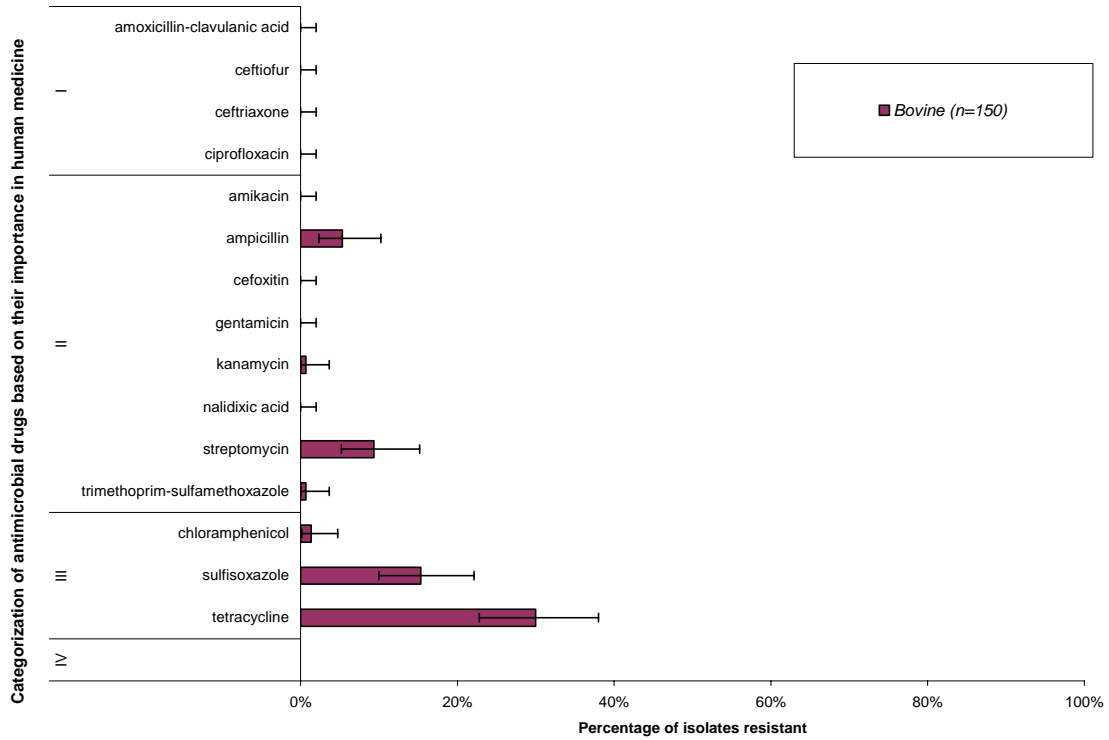
<sup>1</sup> Serovars with less than 2% prevalence are classified in this category.



# Antimicrobial Resistance in *Escherichia coli*

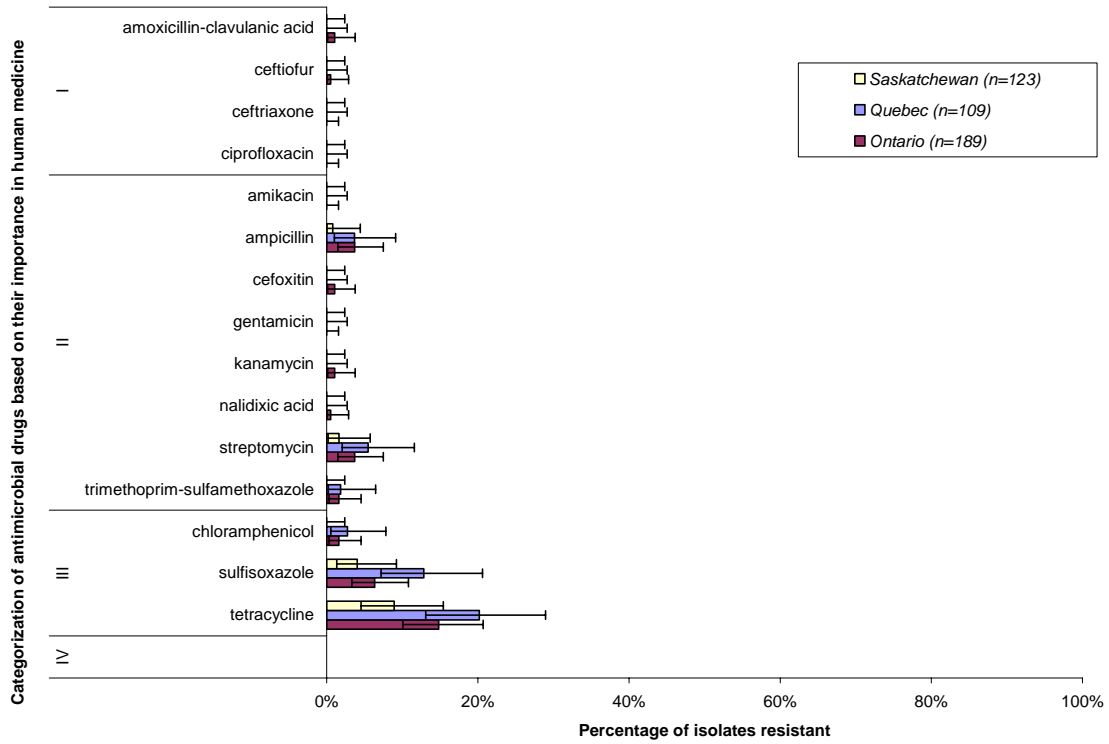
## Abattoir Surveillance

Figure 15. Individual antimicrobial drug resistance in **bovine** *E. coli* isolates; *Abattoir Surveillance*, 2006.



**Retail Meat Surveillance**

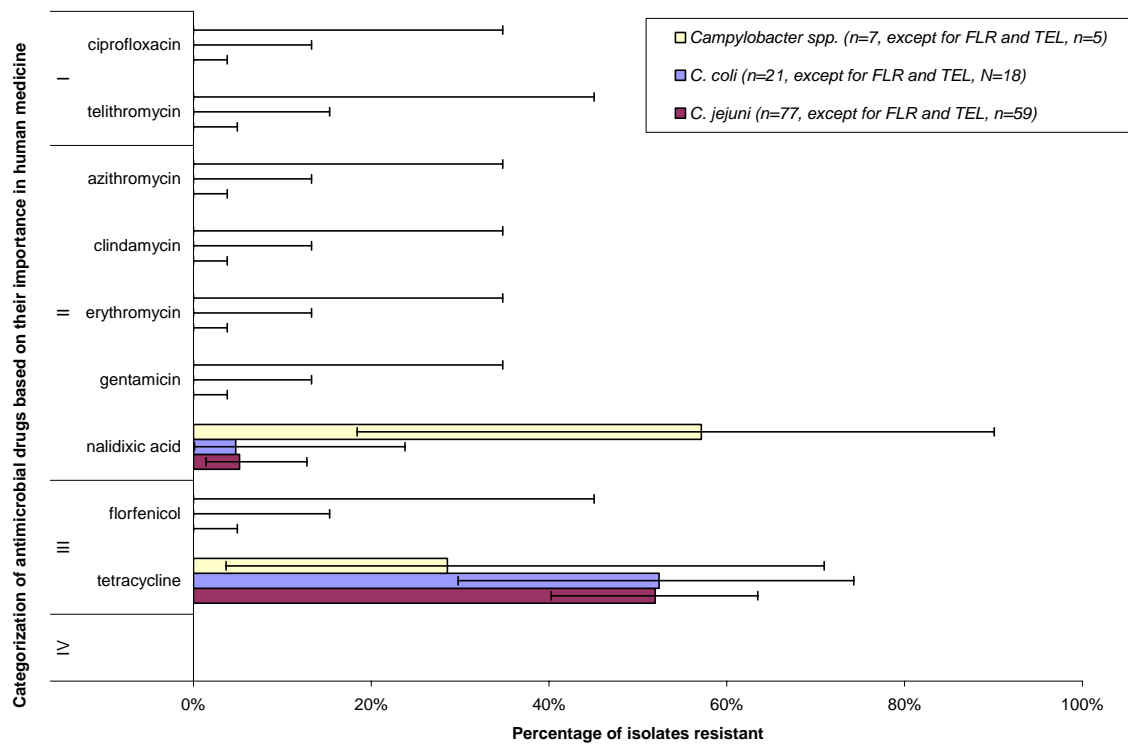
**Figure 16. Individual antimicrobial drug resistance in beef *E. coli* isolates from Saskatchewan, Ontario, and Québec; *Retail Meat Surveillance*, 2006.**



## Antimicrobial Resistance in *Campylobacter*

### Abattoir Surveillance

Figure 17. Individual antimicrobial drug resistance in **bovine *Campylobacter*** isolates across species; *Abattoir Surveillance, 2006*.



Note : FLR=florfenicol, TEL= telithromycine.

Table 22. Number of antimicrobials in resistance pattern of **bovine *Campylobacter*** isolates across serovars; *Abattoir Surveillance, 2006*.

Species	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-2	3-4	5-9
<b>Number of isolates</b>					
<i>C. jejuni</i>	77 (73.3)	34	43	0	0
<i>C. coli</i>	21 (20)	9	12	0	0
<i>Campylobacter</i> spp. <sup>1</sup>	7 (6.7)	2	5	0	0
<b>Total</b>	<b>105</b>	<b>45</b>	<b>60</b>	<b>0</b>	<b>0</b>

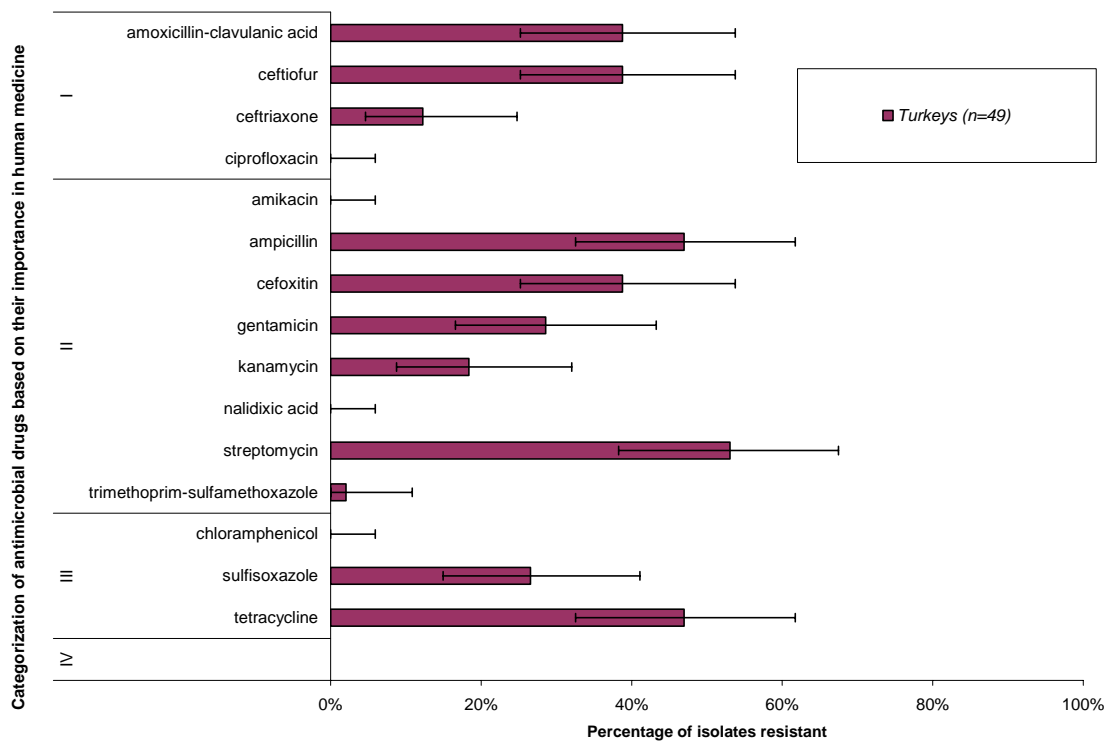
<sup>1</sup> May include some species that are intrinsically resistant to nalidixic acid.

# Turkeys

## Antimicrobial Resistance in *Salmonella*

### Surveillance of Animal Clinical Isolates

Figure 18. Individual antimicrobial drug resistance in turkey *Salmonella* isolates; Surveillance of Animal Clinical Isolates, 2006.



**Table 23. Number of antimicrobials in resistance pattern of turkey *Salmonella* isolates across serovars; *Surveillance of Animal Clinical Isolates*, 2006.**

Serovar	n (%total)	Number of antimicrobials in resistance pattern			
		0	1-4	5-8	9-16
		Number of isolates			
Heidelberg	15 (30.6)	2	4	9	0
Hadar	9 (18.4)	0	9	0	0
Bredeney	6 (12.2)	0	0	0	6
Saintpaul	3 (6.1)	3	0	0	0
Agona	2 (4.1)	0	2	0	0
Brandenburg	2 (4.1)	1	0	1	0
Litchfield	2 (4.1)	0	2	0	0
Montevideo	2 (4.1)	0	1	1	0
Senftenberg	2 (4.1)	0	2	0	0
Albany	1 (2)	0	1	0	0
Anatum	1 (2)	0	1	0	0
Kentucky	1 (2)	0	1	0	0
Ouakam	1 (2)	1	0	0	0
Schwarzengrund	1 (2)	1	0	0	0
Tennessee	1 (2)	0	1	0	0
<b>Total</b>	<b>49</b>	<b>8</b>	<b>24</b>	<b>11</b>	<b>6</b>