NARMS

National Antimicrobial Resistance Monitoring System

2004

Executive Report

Contents

Page Number

I. Introduction 1

A. Executive Report 1
B. NARMS Program 1
C. NARMS Components 2
D. Links to Additional Information 3

II. Methods 4

A. Sampling Methodology 4
B. Antimicrobial Susceptibility Testing Methods 5
C. Breakpoints 6
D. Reporting Methods 9

III. *Salmonella* (non-Typhi) Data 11

A. *Salmonella* (non-Typhi) Isolates Tested 11
B. Isolation of *Salmonella* (non-Typhi) from Retail Meats 12
C. *Salmonella* (non-Typhi) Serotypes 13
D. Antimicrobial Susceptibility among all non-Typhi *Salmonella* 17
E. Antimicrobial Susceptibility among *Salmonella* Typhimurium 34
F. Antimicrobial Susceptibility among *Salmonella* Enteritidis 45
G. Antimicrobial Susceptibility among *Salmonella* Newport 54
H. Antimicrobial Susceptibility among *Salmonella* Heidelberg 64

IV. *Campylobacter* Data 75

A. *Campylobacter jejuni* and *Campylobacter coli* Isolates Tested 75
B. Isolation of *Campylobacter* from Retail Meats 76
C. *Campylobacter* Species 77
D. Antimicrobial Susceptibility among *Campylobacter jejuni* 78
E. Antimicrobial Susceptibility among *Campylobacter coli* 82

V. *Escherichia coli* Data 86

A. *E. coli* Isolates Tested 86
B. Isolation of *E. coli* from Retail Meats 87
C. Antimicrobial Susceptibility among *E. coli* 88

Appendix 95

I. Introduction

A. Executive Report

This report summarizes in an integrated format, National Antimicrobial Resistance Monitoring System data on *Salmonella* and *Campylobacter* isolates recovered in 2004 from food animals at federally inspected plants, retail meats, and humans. The report also includes susceptibility data on *Escherichia coli* isolates recovered from retail meats and chickens in 2004. For comparison purposes, summary data from prior years are included.

Suggested Citation: FDA. National Antimicrobial Resistance Monitoring System – Enteric Bacteria (NARMS): 2004 Executive Report. Rockville, MD: U.S. Department of Health and Human Services, Food and Drug Administration, 2008.

B. NARMS Program

The National Antimicrobial Resistance Monitoring System – Enteric Bacteria (NARMS) is a national public health surveillance system in the United States that tracks changes in the susceptibility of certain enteric bacteria to antimicrobial agents of human and veterinary medical importance. The NARMS program was established in 1996 as a collaboration between three federal agencies: the U.S. Food and Drug Administration (FDA), the Centers for Disease Control and Prevention (CDC), and the U.S. Department of Agriculture (USDA). NARMS also collaborates with scientists involved in antimicrobial resistance monitoring in other countries, including Canada, Denmark, France, Germany, Greece, Italy, Mexico, the Netherlands, Norway, Sweden, and the United Kingdom, so that information can be shared on the global dimensions of antimicrobial resistance in foodborne bacteria.

NARMS monitors antimicrobial susceptibility among enteric bacteria from humans, retail meats, and food animals. Surveillance is conducted for two categories of enteric bacteria: zoonotic bacterial pathogens (*Salmonella* and *Campylobacter*) and other bacteria (*Escherichia coli* and *Enterococcus*). *Salmonella* was chosen as the sentinel pathogen for the NARMS program at its inception in 1996. *Campylobacter* was later added, followed by *E. coli* and *Enterococcus.* Monitoring of *E. coli* and *Enterococcus* isolates was added due to their ubiquitous presence in animals, foods, and humans and their potential to serve as reservoirs of antimicrobial resistance genes for bacterial pathogens. NARMS also examines *Salmonella* and *Campylobacter* isolates for genetic relatedness using pulsed-field gel electrophoresis (PFGE). In addition, NARMS conducts epidemiologic and microbiologic research studies. These studies may include isolates of a particular serotype or those exhibiting a particular resistance pattern or they may focus on improving the culture, isolation, or antimicrobial susceptibility testing methodology of target bacteria. Comprehensive annual NARMS reports are published by CDC, FDA, and USDA. In addition, NARMS data and directed research studies are reported at scientific meetings and published in peer-reviewed scientific journals.

As a public health monitoring system, the primary objectives of NARMS are to:

- Provide data on the extent and temporal trends of antimicrobial resistance in zoonotic foodborne bacterial pathogens and select commensal organisms to veterinarians, physicians, public health authorities, and other stakeholders

- Provide a platform for research studies to better understand the emergence and spread of antimicrobial resistance and assist in the development of science-based strategies to contain or mitigate resistance

- Assist the FDA in making decisions related to the approval of safe and effective drugs for humans and animals, as well as to promote judicious use of antimicrobial drugs

C. NARMS Components

The NARMS program has three components or "arms" which are briefly described below.

1. Human Component

The human component of NARMS was launched in 1996 within the framework of CDC's Emerging Infections Program and the Foodborne Diseases Active Surveillance Network (FoodNet). Antimicrobial susceptibility testing of NARMS human isolates is performed at CDC's laboratories in the National Center for Zoonotic, Vector-Borne, and Enteric Diseases (NCZVED) in Atlanta, Georgia.

The program initially included non-Typhi *Salmonella* and *E. coli* O157:H7 isolates from 14 state and local health departments. It later expanded to include additional bacteria and testing sites. In 1997, testing was expanded to include monitoring of resistance among *Campylobacter* isolates from humans in five sites participating in FoodNet. In 1999, testing of *Salmonella* Typhi and *Shigella* isolates was added. Since 2003, all 50 states have been forwarding to CDC a representative sample of non-Typhi *Salmonella*, *Salmonella* Typhi, *Shigella*, and *E. coli* O157 isolates for antimicrobial susceptibility testing. Testing of *Campylobacter* also expanded over time and in 2004, 10 FoodNet states participated in *Campylobacter* surveillance.

An enterococci resistance study began in 2001 to monitor antimicrobial resistance among enterococci isolated from human stool samples. Stool samples were collected from outpatients at four sites and healthy volunteers at one site. An *E. coli* component was added to the study in 2004. Stool specimens for the *E. coli* study were from outpatients at two sites.

2. Retail Meat Component

The retail meat component of NARMS was launched in 2002, following a 15-month pilot study in Iowa. Retail meat surveillance is conducted through an ongoing collaboration between FDA's Center for Veterinary Medicine (CVM), CDC, and FoodNet laboratories. Participating FoodNet sites purchased chicken breasts, ground turkey, ground beef, and pork chops at retail stores and cultured them for *Salmonella* and *Campylobacter*. Four sites also cultured retail meats for *E. coli* and *Enterococcus*. Bacterial identification and antimicrobial susceptibility testing of retail meat isolates was performed at CVM's Office of Research in Laurel, Maryland.

3. Animal Component

The animal component of NARMS was launched in 1997 after pilot studies were conducted in 1995 and 1996. Antimicrobial susceptibility testing of animal isolates is conducted at the USDA's Agricultural Research Service (ARS) Bacterial Epidemiology and Antimicrobial Resistance Research Unit at the Russell Research Center in Athens, Georgia.

Salmonella isolates recovered from chickens, turkeys, cattle, and swine at slaughter were submitted to the NARMS program through the USDA Food Safety and Inspection Service (FSIS) Pathogen Reduction/Hazard Analysis and Critical Control Point (PR/HACCP) verification testing program. *Salmonella* isolates from USDA baseline studies, ready-to-eat sampling programs, and diagnostic and on-farm sources were also tested, but data on these isolates are not included in this report. The program was later expanded to include monitoring of resistance among *Campylobacter* (1998), *E. coli* (2000), and *Enterococcus* (2003) isolates from chicken carcass rinsates collected at slaughter for the PR/HACCP verification testing program.

D. Links to Additional Information

Additional information about NARMS, including comprehensive annual reports for each NARMS component, can be found on the CDC, FDA, and USDA websites listed below. The FDA website also contains a link to this Executive Report and the NARMS 2003 Executive Report.

CDC: http://www.cdc.gov/narms

FDA: http://www.fda.gov/cvm/narms_pg.html

USDA: http://ars.usda.gov/Main/docs.htm?docid=6750

Information about the Foodborne Diseases Active Surveillance Network (FoodNet) can be found on the following CDC website: http://www.cdc.gov/foodnet/

II. Methods

A. Sampling Methodology

Sample collection is an integral part of many public health surveillance systems, including NARMS. Sampling strategies necessarily differ among the three components of NARMS and are described below.

1. Human Component

Sampling for the human pathogens depends on public health laboratory-based surveillance and is driven by the occurrence of laboratory-confirmed cases. NARMS testing of non-Typhi *Salmonella* began in 1996 with isolates from 14 states. Subsequently, additional states joined the program. Since 2003, *Salmonella* isolates have been collected from clinical laboratories by state and local health departments in all 50 states and sent to CDC for susceptibility testing. From 1996 through 2002, participating sites submitted every tenth non-Typhi *Salmonella* they received to CDC for antimicrobial susceptibility testing. In 2003 and 2004, participating sites submitted every 20th isolate. *Salmonella* serotyping was performed by the participating state and local public health laboratories prior to shipping.

Surveillance for *Campylobacter* began in 1997 with five FoodNet sites submitting one isolate each week. This was expanded through the years, and in 2004, *Campylobacter* isolates were submitted from 10 FoodNet sites (California, Colorodo, Connecticut, Georgia, Maryland, Minnesota, New Mexico, New York, Oregon, and Tennessee); one isolate per week was tested from each site.[1]

2. Retail Meat Component

In 2002, retail meat sampling began in January with FoodNet laboratories in Connecticut, Georgia, Maryland, Minnesota, and Tennessee; Oregon joined in September. FoodNet laboratories in California and New York joined in 2003, while FoodNet laboratories in Colorado and New Mexico joined in 2004.

Each FoodNet site attempted to purchase a total of 40 meat samples per month, including 10 samples each of chicken breasts, ground turkey, ground beef, and pork chops. An attempt was made by each site to sample as many different stores as possible each month and to purchase as many different brands of fresh (not frozen) meat and poultry as possible. All sites cultured the retail meats for *Salmonella* and *Campylobacter*. Four sites (Georgia, Maryland, Oregon, and Tennessee) also cultured the meats for *E. coli* and *Enterococcus*. Once identified, bacterial isolates were sent to CVM's Office of Research for further characterization, including serotype (*Salmonella*) or species (*Campylobacter* and *Enterococcus*) confirmation and antimicrobial susceptibility testing.

[1] Further details about sampling of *Campylobacter* isolates can be found in the NARMS Human Isolates Final Report for 2004.

3. Animal Component

The animal component of NARMS was launched in 1997 and initially included monitoring of antimicrobial susceptibility among *Salmonella*. Data for *Salmonella* isolates from food animals at slaughter are included in this report. The isolates were recovered from carcass rinsates (chicken), carcass swabs (turkey, cattle, and swine), and ground products (chicken, turkey, and beef) collected at federally inspected slaughter and processing plants throughout the U.S. as part of the FSIS PR/HACCP verification testing program and pre-implementation testing. Serotyping was performed by the National Veterinary Services Laboratories (NVSL).

USDA began testing *Campylobacter* isolates in 1998. From 1998 to 2000, *Campylobacter* isolates from chickens were obtained from a variety of FSIS programs for inclusion in NARMS. In 1998, *Campylobacter* isolates were submitted only from the Eastern FSIS laboratory, whereas in 1999 and 2000, isolates were obtained from all three FSIS laboratories (Eastern, Midwestern, and Western laboratories). FSIS cultured samples for *Campylobacter* using the most probable number method described in the FSIS Microbiology Laboratory Guidebook.[1] Nalidixic acid susceptibility and cephalothin resistance were initially used as identification criteria for *Campylobacter jejuni/coli*. This likely resulted in an underreporting of quinolone resistant *Campylobacter* until 2001, when use of this method was discontinued. From January through June 2001, various isolation methods were compared and a new ARS method was adopted in July of 2001. Since that time, *Campylobacter* reported in the NARMS animal component have been isolated by ARS from spent chicken carcass rinsates submitted by the Eastern FSIS laboratory. The rinsates were collected as part of the *Salmonella* PR/HACCP verification testing program. In addition to testing the *Campylobacter* isolates for antimicrobial susceptibility, the ARS laboratory speciated the isolates. This Executive Report contains data on *Campylobacter* recovered from chicken carcass rinsates for the period July 2001 through December 2004, when the new ARS isolation method was used.

USDA began testing *E. coli* isolates for antimicrobial susceptibility in 2000. ARS isolated the *E. coli* from spent chicken carcass rinsates submitted by the Eastern FSIS laboratory. The rinsates were collected as part of the *Salmonella* PR/HACCP verification testing program.

B. Antimicrobial Susceptibility Testing Methods

The dilution schemes and antimicrobial content of the susceptibility testing panels have undergone several design iterations as the NARMS program has matured. This has resulted in testing arrays that now meet international standards for quality control. The content of the panels was amended, as appropriate, to accommodate new antimicrobial agents entering the market, to omit those no longer available or used, or to adjust dilution ranges. The susceptibility testing panel formats undergo annual review for possible improvements. Customized testing panels have also been designed, and are available for use in phenotypic assessment of extended spectrum beta-lactam and fluoroquinolone resistance.

Antimicrobial minimum inhibitory concentrations (MICs) for *Salmonella* and *E. coli* were determined according to manufacturer instructions using the Sensititre® semi-automated antimicrobial susceptibility system (Trek Diagnostic Systems, Westlake, Ohio). In 2004, *Salmonella* and *E. coli* isolates were tested using a custom plate developed for Gram negative

[1] http://www.fsis.usda.gov/Science/Microbiological_Lab_Guidebook/index.asp

bacteria (catalog # CMV1AGNF). Clinical and Laboratory Standards Institute (CLSI)[1] recommended quality control organisms were used each time that antimicrobial susceptibility testing was performed. The quality control organisms included *Escherichia coli* ATCC 25922, *Enterococcus faecalis* ATCC 29212, *Staphylococcus aureus* ATCC 29213, and *Pseudomonas aeruginosa* ATCC 27853.[2,3] Two content changes were made in the *Salmonella*/*E. coli* plate format in 2004: cephalothin was omitted from the testing panel and sulfamethoxazole was replaced with sulfisoxazole.

Methods used to determine antimicrobial MICs for *Campylobacter* have changed over time. Through 2004, the human and animal components of NARMS used Etest® (AB Biodisk, Solna, Sweden). The antimicrobial agents tested using Etest® included: azithromycin, chloramphenicol, ciprofloxacin, clindamycin, erythromycin, gentamicin, nalidixic acid, and tetracycline. Based on Etest® manufacturer recommendations, MIC results that fell between the two-fold dilutions described in CLSI documents were rounded up to next two-fold dilution before interpretation.[4] The retail component used the CLSI-approved agar dilution method in 2002 and 2003. Recognizing the need for a standardized semi-automated method, CVM developed a broth microdilution method. The retail component began using this method in 2004 and the human and food animal components adopted the method in 2005. This standardized method was approved and published by CLSI in 2006.[5] Testing was done using the Sensititre® semi-automated antimicrobial susceptibility system (Trek Diagnostic Systems, Westlake, Ohio) and a custom plate developed for *Campylobacter* (catalog # CAMPY). The antimicrobial agents included in the broth microdilution testing were: azithromycin, ciprofloxacin, clindamycin, erythromycin, florfenicol, gentamicin, nalidixic acid, telithromycin, and tetracycline. *Campylobacter jejuni* ATCC 33560 was used as the quality control organism.

C. Breakpoints

The breakpoints used in this report are shown in Tables 1 and 2. CLSI-approved breakpoints were used when available. For *Salmonella* and *E. coli*, CLSI breakpoints were available for all antimicrobials tested except streptomycin. For *Campylobacter*, CLSI breakpoints were available only for ciprofloxacin, doxycycline, erythromycin, and tetracycline. NARMS breakpoints were used when CLSI breakpoints were not available. NARMS breakpoints were established based on the MIC distributions of NARMS isolates. Since the NARMS 2003 Executive Report was published in 2006, there were changes in the breakpoints for *Campylobacter* for the following antimicrobial agents: azithromycin, clindamycin, doxycycline, erythromycin, gentamicin, and nalidixic acid. Resistance data for all years were recalculated using the new breakpoints.

---

[1] The organization was known as the National Committee on Clinical Laboratory Standards (NCCLS) until the name was changed in January of 2005 to CLSI. In this report, the name CLSI is used.

[2] **NCCLS**. 2002. Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated from Animals; Approved Standard—Second Edition. NCCLS document M31-A2. NCCLS, Wayne, PA.

[3] **NCCLS**. 2003. Performance Standards for Antimicrobial Susceptibility Testing; Thirteenth Informational Supplement. NCCLS document M100-S13. NCCLS, Wayne, PA.

[4] In USDA's NARMS annual reports, MIC values were not rounded up prior to interpretation.

[5] **CLSI**. 2006. Methods for Antimicrobial Dilution and Disk Susceptibility Testing of Infrequently Isolated or Fastidious Bacteria; Approved Guideline. CLSI document M45-A. CLSI, Wayne, PA.

Table 1. Breakpoints Used for Susceptibility Testing of *Salmonella* and *E. coli*[1]

Antimicrobial Class	Antimicrobial Agent	MIC Breakpoints (µg/ml)		
		Susceptible	Intermediate	Resistant
Aminoglycosides	Amikacin	≤ 16	32	≥ 64
	Gentamicin	≤ 4	8	≥ 16
	Kanamycin	≤ 16	32	≥ 64
	Streptomycin	≤ 32	N/A	≥ 64
Aminopenicillins	Ampicillin	≤ 8	16	≥ 32
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin–Clavulanic Acid	≤ 8 / 4	16 / 8	≥ 32 / 16
Cephalosporins	Ceftiofur	≤ 2	4	≥ 8
	Ceftriaxone	≤ 8	16 - 32	≥ 64
	Cephalothin[2]	≤ 8	16	≥ 32
Cephamycins	Cefoxitin	≤ 8	16	≥ 32
Folate Pathway Inhibitors	Sulfamethoxazole/Sulfisoxazole[3]	≤ 256	N/A	≥ 512
	Trimethoprim–Sulfamethoxazole	≤ 2 / 38	N/A	≥ 4 / 76
Phenicols	Chloramphenicol	≤ 8	16	≥ 32
Quinolones	Ciprofloxacin	≤ 1	2	≥ 4
	Nalidixic acid	≤ 16	N/A	≥ 32
Tetracyclines	Tetracycline	≤ 4	8	≥ 16

[1] Breakpoints were adopted from CLSI (Clinical and Laboratory Standards Institute), except for streptomycin, which has no CLSI breakpoints

[2] Cephalothin was tested through 2003

[3] Sulfamethoxazole was tested from 1996 through 2003 and was replaced by sulfisoxazole in 2004

Table 2. Breakpoints Used for Susceptibility Testing of *Campylobacter*[1]

Antimicrobial Class	Antimicrobial Agent	MIC Breakpoints (µg/ml)		
		Susceptible	Intermediate	Resistant
Aminoglycosides	Gentamicin	≤ 2	4	≥ 8
Ketolides	Telithromycin	≤ 4	8	≥ 16
Lincosamides	Clindamycin	≤ 2	4	≥ 8
Macrolides	Azithromycin	≤ 2	4	≥ 8
	Erythromycin	≤ 8	16	≥ 32
Phenicols	Chloramphenicol	≤ 8	16	≥ 32
	Florfenicol[2]	≤ 4	N/A	N/A
Quinolones	Ciprofloxacin	≤ 1	2	≥ 4
	Nalidixic acid	≤ 16	32	≥ 64
Tetracyclines	Doxycycline	≤ 2	4	≥ 8
	Tetracycline	≤ 4	8	≥ 16

[1] Breakpoints were adopted from CLSI (Clinical and Laboratory Standards Institute), when available. CLSI breakpoints were available for erythromycin, ciprofloxacin, doxycyline, and tetracycline

[2] For florfenicol, only a susceptible breakpoint (≤ 4 µg/ml) has been established. In this report, isolates with an MIC ≥ 8 µg/ml are categorized as resistant

D. Reporting Methods

The remaining three sections of this report contain NARMS surveillance data for *Salmonella*, *Campylobacter*, and *E. coli*. Section III contains data for *Salmonella* isolates recovered from food animals at slaughter, retail meats, and humans. Antimicrobial susceptibility data are presented for all non-Typhi *Salmonella,* as well as the following four *Salmonella* serotypes: Typhimurium, Enteritidis, Newport, and Heidelberg. Section IV contains data for *Campylobacter* isolates recovered from humans, retail meats, and chicken carcass rinsates. Antimicrobial susceptibility data for *C. jejuni* and *C. coli* are presented separately. Section V contains susceptibility data for *E. coli* isolates from retail meats and chicken carcass rinsates.

Each section begins with a table that shows the number of isolates tested by source and year. This is followed by a table and two figures that show the percentages of retail meats that tested positive. Data are also provided on the distribution of *Salmonella* serotypes and *Campylobacter* species isolated from humans, retail meats, and food animals.

Data on antimicrobial susceptibility follows. MIC distribution tables include MIC distributions, the percentages of isolates displaying intermediate susceptibility and resistance, and 95% confidence intervals for the percent resistant, by source for 2004. Confidence intervals were calculated using the Clopper-Pearson exact method.[1] The unshaded areas in the MIC tables indicate the range of concentrations tested for each antimicrobial.[2] Single vertical bars indicate antimicrobial susceptibility breakpoints, while double vertical bars indicate antimicrobial resistance breakpoints.

The MIC distributions are followed by tables that show the numbers and percentages of isolates that were resistant, by year, through 2004.[3] The total number of isolates tested per year for each source is listed at the top of each table. An empty cell in this area indicates that surveillance was not conducted for that particular source, whereas a zero indicates that surveillance was conducted, but no isolates were available for testing. Below the section containing the number of isolates tested, empty shaded boxes indicate that there are no data to report because surveillance was not conducted or isolates were not available for testing.

Resistance to ceftiofur and nalidixic acid among *Salmonella* isolates is highlighted in several pie charts and graphs (Figures 6-14).[4,5] Third-generation cephalosporins (such as ceftriaxone) and fluoroquinolones (such as ciprofloxacin) are antimicrobial agents commonly used for the treatment of severe *Salmonella* infections in humans. Ceftiofur is the only third-generation cephalosporin approved for use in food animals in the U.S. and elevated MICs ($\geq$ 8 µg/ml) correlate with decreased susceptibility to ceftriaxone (MIC $\geq$ 2 µg/ml). Similarly, resistance to the quinolone nalidixic acid (MIC $\geq$ 32 µg/ml) correlates with decreased susceptibility to ciprofloxacin (MIC $\geq$ 0.125 µg/ml). Finally, for *Salmonella* and *E. coli* isolates, data on multidrug resistance (MDR) phenotypes of public health importance are also presented (Tables 13-17, 21, 24, 28, 32, and 47).

---

[1] Newcombe RG. Two-sided confidence intervals for the single proportion: comparison of seven methods. Statistics in Medicine 1998; 17(8): 857-872.

[2] The concentration ranges are also listed in the Appendix.

[3] Data on *Campylobacter* recovered from chickens is presented only for the period of July 2001 through December 2004, as described in Section IIA.

[4] Note that the scales vary from figure to figure, based on the maximum percent resistance.

[5] Below each graph is a table that shows the number of isolates tested. Empty grey boxes indicate that surveillance was not conducted, while boxes with zeros indicate that there were no isolates available for testing.

The data contained in this report may, in a few cases, differ from those previously reported. These differences may be due to changes in breakpoints (*Campylobacter*) and/or the dynamic nature of the data, which are updated if new information is obtained about the bacterial isolates under surveillance or specific isolates are retested. In a few cases, differences may be due to other reasons. Etest® MIC results for *Campylobacter* that fell between the two-fold dilutions described in CLSI documents were rounded up to next two-fold dilution prior to interpretation in this report, but not in USDA's annual reports.

III. *Salmonella* (non-Typhi) Data

A. *Salmonella* (non-Typhi) Isolates Tested

Table 3. Number of *Salmonella* (non-Typhi) Isolates Tested, by Source and Year, 1996-2004

Source	Year								
	1996	1997	1998	1999	2000	2001	2002	2003	2004
Humans	1324	1301	1460	1497	1377	1419	2008	1864	1793
Chicken Breasts							60	83	157
Ground Turkey							74	114	142
Ground Beef							9	10	14
Pork Chops							10	5	11
Chickens		214	561	1438	1173	1307	1500	1158	1280
Turkeys		107	240	713	518	550	244	262	236
Cattle		24	284	1610	1388	893	1008	670	607
Swine		111	793	876	451	418	379	211	308

B. Isolation of *Salmonella* (non-Typhi) from Retail Meats

Table 4. Number and Percent of Retail Meat Samples Positive for *Salmonella*, 2004

	Chicken Breasts	Ground Turkey	Ground Beef	Pork Chops
Number of Meat Samples Tested	1172	1165	1186	1176
Number Positive for *Salmonella*	157	142	14	11
Percent Positive for *Salmonella*	13.4%	12.2%	1.2%	0.9%

Figure 1. Percent of Retail Meat Samples Positive for *Salmonella*, 2004

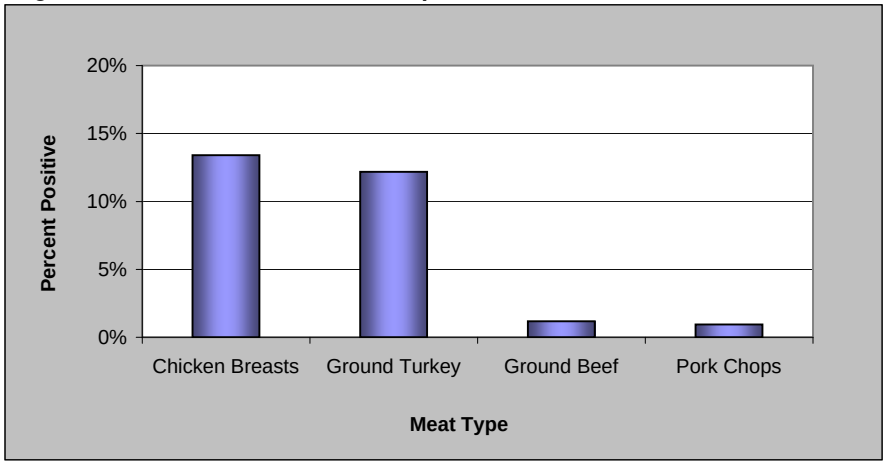
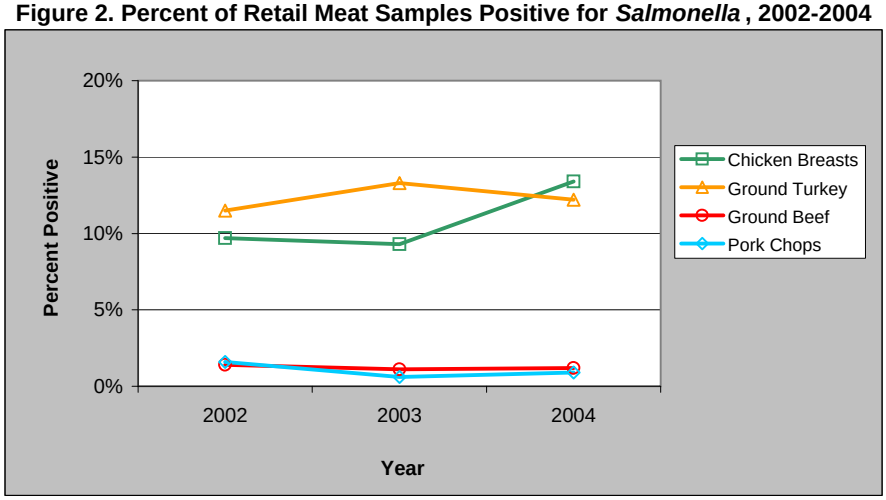


Figure 2. Percent of Retail Meat Samples Positive for *Salmonella*, 2002-2004



C. *Salmonella* (non-Typhi) Serotypes

Table 5. Most Common Serotypes among *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, 2004

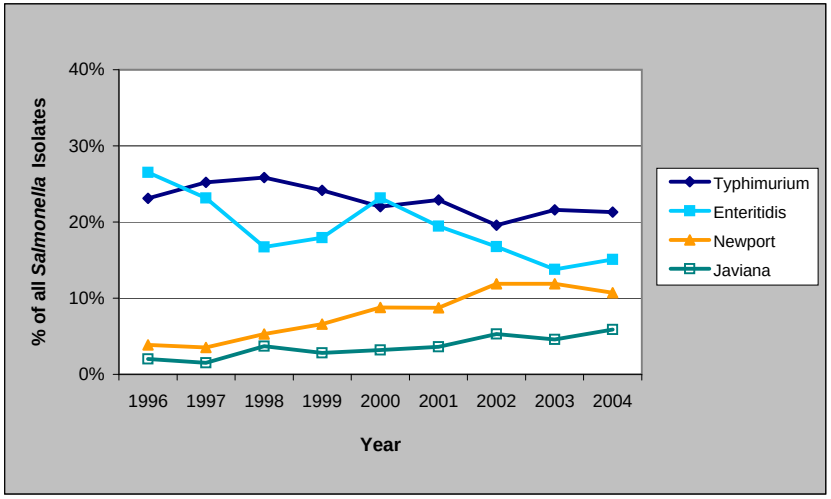
Humans				Retail Meats				Food Animals			
Source	**Serotype**	**n**	**%**	**Meat Type**	**Serotype**	**n**	**%**	**Animal Source**	**Serotype**	**n**	**%**
Humans (n=1793)	Typhimurium	382	21.3	**Chicken Breasts (n=157)**	Typhimurium	49	31.2	**Chickens (n=1280)**	Kentucky	570	44.5
	Enteritidis	271	15.1		Kentucky	42	26.8		Typhimurium	171	13.4
	Newport	191	10.7		Heidelberg	31	19.7		Heidelberg	167	13.0
	Javiana	106	5.9		Hadar	8	5.1		Enteritidis	84	6.6
	Heidelberg	93	5.2		Schwarzengrund	5	3.2		I 4,[5],12:i:-	44	3.4
	Montevideo	50	2.8		Mbandaka	4	2.5		Schwarzengrund	36	2.8
	I 4,[5],12:i:-	36	2.0		I 4,12:i:-	4	2.5		Montevideo	29	2.3
	Braenderup	33	1.8		Enteritidis	3	1.9		Thompson	23	1.8
	Muenchen	32	1.8		Montevideo	3	1.9		Infantis	19	1.5
	Oranienburg	32	1.8		Berta	2	1.3		Mbandaka	19	1.5
	Saintpaul	32	1.8		Agona	2	1.3		Hadar	11	0.9
	Paratyphi B[1]	30	1.7								
	Infantis	29	1.6	**Ground Turkey (n=142)**	Heidelberg	37	26.1	**Turkeys (n=236)**	Heidelberg	46	19.5
	Thompson	26	1.5		Saintpaul	24	16.9		Hadar	31	13.1
	Agona	24	1.3		Reading	16	11.3		Reading	18	7.6
	Mississippi	24	1.3		Schwarzengrund	16	11.3		Saintpaul	16	6.8
	Hartford	18	1.0		Hadar	11	7.7		Derby	15	6.4
	Anatum	16	0.9		Agona	6	4.2		IIIa 18:z4,z23:-	14	5.9
	Berta	14	0.8		IIIa 18:z4,z32:-	6	4.2		Typhimurium	14	5.9
	Mbandaka	14	0.8		Muenster	4	2.8		Senftenberg	11	4.7
					Derby	3	2.1		Schwarzengrund	9	3.8
					IIIa 18:z4,z23:-	2	1.4		Newport	7	3.0
					I 4,12,:i:-	2	1.4		Kentucky	6	2.5
					Berta	2	1.4		Muenster	6	2.5
					Montevideo	2	1.4		Berta	5	2.1
					Newport	2	1.4		Muenchen	5	2.1
					Senftenberg	2	1.4				
					Typhimurium	2	1.4				
				Ground Beef (n=14)	Braenderup	5	35.7	**Cattle (n=607)**	Montevideo	82	13.5
					Muenster	5	35.7		Anatum	66	10.9
					Newport	2	14.3		Muenster	54	8.9
					Berta	1	7.1		Typhimurium	48	7.9
					Dublin	1	7.1		Newport	44	7.2
									Agona	41	6.8
									Dublin	30	4.9
									Kentucky	25	4.1
									Reading	21	3.5
									Mbandaka	19	3.1
									Infantis	18	3.0
				Pork Chops (n=11)	Braenderup	5	45.5	**Swine (n=308)**	Derby	84	27.3
					Heidelberg	3	27.3		Typhimurium	53	17.2
					Typhimurium	2	18.2		Anatum	32	10.4
					Agona	1	9.1		Infantis	22	7.1
									Adelaide	15	4.9
									Reading	12	3.9
									Johannesburg	11	3.6
									Muenchen	10	3.2
									Hadar	10	3.2
									Brandenburg	6	1.9
									Mbandaka	6	1.9

[1] Paratyphi B var. L(+) tartrate+

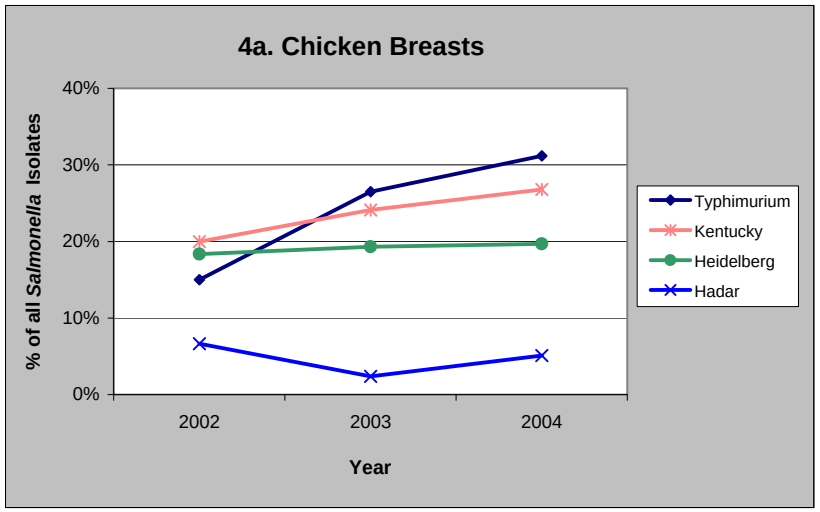
Table 6. Most Common *Salmonella* (non-Typhi) Serotypes in Humans and their Distributions among Retail Meat and Food Animal Isolates, by Meat Type and Animal Source, 2004

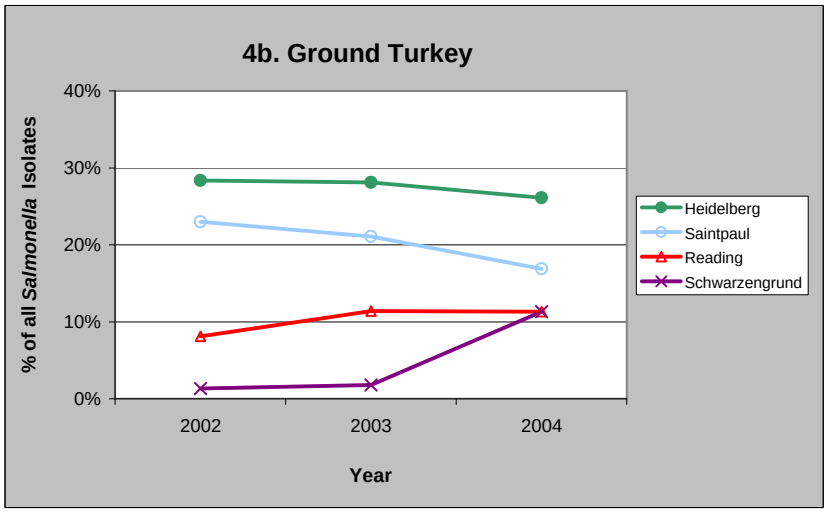
	Humans	Retail Meats				Food Animals			
	Humans (n=1793)	Chicken Breast (n=157)	Ground Turkey (n=142)	Ground Beef (n=14)	Pork Chops (n=11)	Chickens (n=1280)	Turkeys (n=236)	Cattle (n=607)	Swine (n=308)
1. Typhimurium	21.3% 382	31.2% 49	1.4% 2	0.0% 0	18.2% 2	13.4% 171	5.9% 14	7.9% 48	17.2% 53
2. Enteritidis	15.1% 271	1.9% 3	0.0% 0	0.0% 0	0.0% 0	6.6% 84	0.0% 0	0.3% 2	0.3% 1
3. Newport	10.7% 191	0.0% 0	1.4% 2	14.3% 2	0.0% 0	0.0% 0	3.0% 7	7.2% 44	0.0% 0
4. Javiana	5.9% 106	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
5. Heidelberg	5.2% 93	19.7% 31	26.1% 37	0.0% 0	27.3% 3	13.0% 167	19.5% 46	0.2% 1	1.3% 4
6. Montevideo	2.8% 50	1.9% 3	1.4% 2	0.0% 0	0.0% 0	2.3% 29	1.7% 4	13.5% 82	0.0% 0
7. I 4,[5],12:i:-	2.0% 36	2.5% 4	0.0% 0	0.0% 0	0.0% 0	3.4% 44	0.4% 1	0.7% 4	0.0% 0
8. Braenderup	1.8% 33	0.6% 1	0.0% 0	35.7% 5	45.5% 5	0.5% 7	0.4% 1	2.1% 13	0.0% 0
9. Muenchen	1.8% 32	0.6% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.1% 5	1.3% 8	3.2% 10
10. Oranienburg	1.8% 32	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.5% 7	0.0% 0	0.2% 1	0.0% 0
11. Saintpaul	1.8% 32	0.0% 0	16.9% 24	0.0% 0	0.0% 0	0.0% 0	6.8% 16	0.7% 4	1.3% 4

Figure 3. Most Common *Salmonella* (non-Typhi) Serotypes from Humans in 2004 and their Relative Frequencies, by Year, 1996-2004

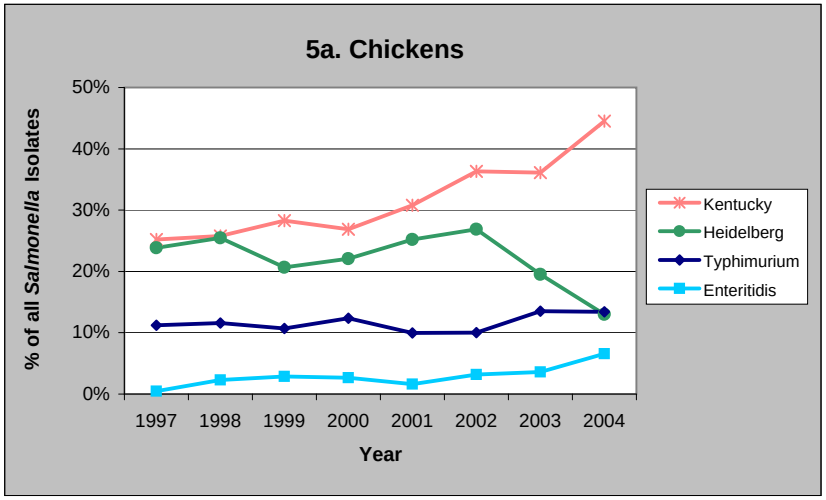


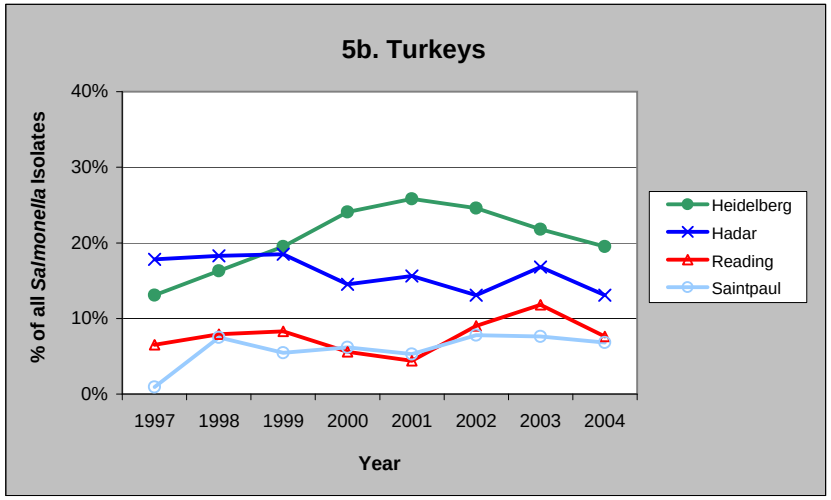
Figures 4a-b. Most Common *Salmonella* (non-Typhi) Serotypes from Retail Poultry in 2004 and their Relative Frequencies, by Year, 2002-2004

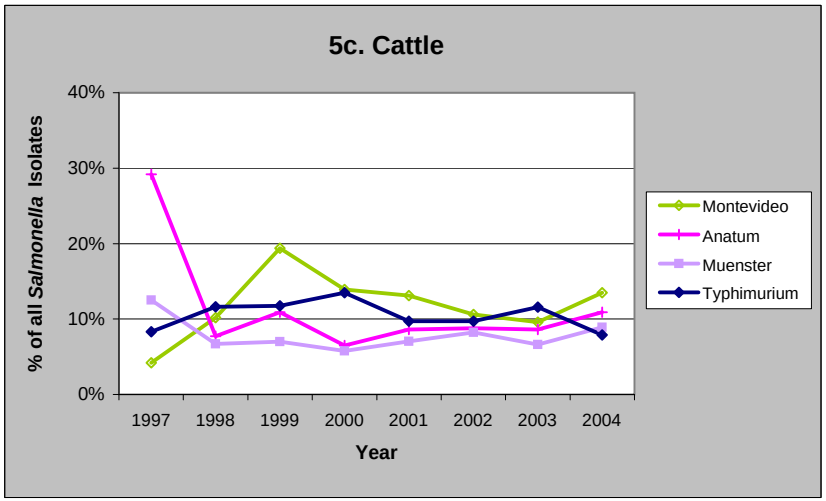


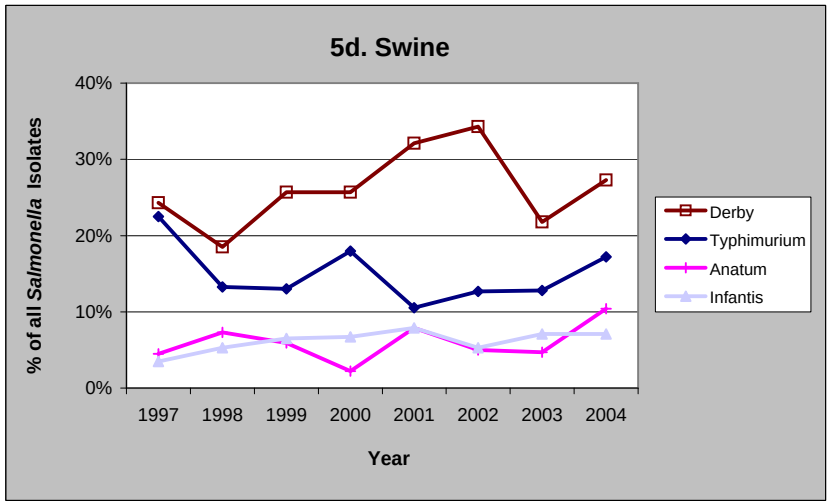


Figures 5a-d. Most Common *Salmonella* (non-Typhi) Serotypes from Food Animals in 2004 and their Relative Frequencies, by Year, 1997-2004









D. Antimicrobial Susceptibility among all non-Typhi *Salmonella*

MIC Distributions

Table 7a. Distribution of MICs and Occurrence of Resistance among all *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)	%I[1]	%R[2]	[95% CI][3]	Distribution (%) of MICs (µg/ml)[4]															
					0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Aminoglycosides																					
Amikacin	Humans (1793)	0.0	**0.0**	[0.0 - 0.2]						7.8	69.5	20.0	2.5	0.2							
	Chicken Breasts (157)	0.0	**0.0**	[0.0 - 2.3]						7.6	46.5	40.1	5.7								
	Ground Turkey (142)	0.0	**0.0**	[0.0 - 2.6]						2.1	50.0	44.4	3.5								
	Ground Beef (14)	0.0	**0.0**	[0.0 - 23.2]							64.3	28.6	7.1								
	Pork Chops (11)	0.0	**0.0**	[0.0 - 28.5]							63.6	27.3	9.1								
	Chickens (1280)	0.0	**0.0**	[0.0 - 0.3]						16.7	67.1	14.8	1.4								
	Turkeys (236)	0.0	**0.0**	[0.0 - 1.6]						8.9	72.0	16.5	2.5								
	Cattle (607)	0.0	**0.0**	[0.0 - 0.6]						10.9	67.5	19.1	2.1	0.3							
	Swine (308)	0.0	**0.0**	[0.0 - 1.2]						9.4	62.7	24.4	3.6								
Gentamicin	Humans (1793)	0.4	**1.3**	[0.9 - 2.0]					68.4	27.7	2.0	0.2	0.1	0.4	**0.6**	**0.8**					
	Chicken Breasts (157)	0.6	**3.8**	[1.4 - 8.1]					46.5	45.2	3.8			0.6	**1.9**	**1.9**					
	Ground Turkey (142)	2.8	**20.4**	[14.1 - 28.0]					33.8	37.3	4.9	0.7		2.8	**9.2**	**11.3**					
	Ground Beef (14)	0.0	**0.0**	[0.0 - 23.2]					57.1	42.9											
	Pork Chops (11)	0.0	**0.0**	[0.0 - 28.5]					63.6	36.4											
	Chickens (1280)	0.2	**4.9**	[3.8 - 6.3]					70.2	23.1	1.5	0.1		0.2	**2.7**	**2.2**					
	Turkeys (236)	5.9	**25.4**	[20.0 - 31.5]					48.7	19.1	0.8			5.9	**14.8**	**10.6**					
	Cattle (607)	0.8	**1.8**	[0.9 - 3.2]					60.6	34.1	2.1	0.5		0.8	**0.8**	**1.0**					
	Swine (308)	0.0	**1.3**	[0.4 - 3.3]					53.9	42.2	2.6				**1.0**	**0.3**					
Kanamycin	Humans (1793)	0.2	**2.8**	[2.1 - 3.7]										96.7	0.3	0.2	**0.2**	**2.6**			
	Chicken Breasts (157)	0.6	**11.5**	[6.9 - 17.5]										84.7	3.2	0.6		**11.5**			
	Ground Turkey (142)	1.4	**18.3**	[12.3 - 25.7]										78.9	1.4	1.4	**7.0**	**11.3**			
	Ground Beef (14)	0.0	**0.0**	[0.0 - 23.2]										100.0							
	Pork Chops (11)	0.0	**9.1**	[0.2 - 41.3]										81.8	9.1			**9.1**			
	Chickens (1280)	0.1	**2.7**	[1.8 - 3.7]										96.9	0.4	0.1	**0.5**	**2.2**			
	Turkeys (236)	4.2	**14.4**	[10.2 - 19.5]										80.9	0.4	4.2	**3.0**	**11.4**			
	Cattle (607)	0.2	**8.9**	[6.8 - 11.4]										90.8	0.2	0.2		**8.9**			
	Swine (308)	0.0	**3.9**	[2.0 - 6.7]										96.1				**3.9**			
Streptomycin	Humans (1793)	N/A	**11.8**	[10.4 - 13.4]												88.2	**5.7**	**6.1**			
	Chicken Breasts (157)	N/A	**28.0**	[21.2 - 35.7]												72.0	**16.6**	**11.5**			
	Ground Turkey (142)	N/A	**34.5**	[26.7 - 42.9]												65.5	**21.1**	**13.4**			
	Ground Beef (14)	N/A	**14.3**	[1.8 - 42.8]												85.7		**14.3**			
	Pork Chops (11)	N/A	**27.3**	[6.0 - 61.0]												72.7		**27.3**			
	Chickens (1280)	N/A	**22.2**	[19.9 - 24.6]												77.8	**14.9**	**7.3**			
	Turkeys (236)	N/A	**33.9**	[27.9 - 40.3]												66.1	**18.6**	**15.3**			
	Cattle (607)	N/A	**20.9**	[17.8 - 24.4]												79.1	**3.8**	**17.1**			
	Swine (308)	N/A	**36.4**	[31.0 - 42.0]												63.6	**10.4**	**26.0**			

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[4] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 7b. Distribution of MICs and Occurrence of Resistance among all *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)	%I[1]	%R[2]	[95% CI][3]	Distribution (%) of MICs (µg/ml)[4] 0.015	0.03	0.06	0.125	0.25	0.5	1	2	4	8	16	32	64	128	256	512	1024
Aminopenicillins																					
Ampicillin	Humans (1793)	0.1	**12.0**	[10.6 - 13.6]							60.4	25.8	1.7		0.1	**0.1**	**12.0**				
	Chicken Breasts (157)	0.0	**30.6**	[23.5 - 38.4]							60.5	8.9					**30.6**				
	Ground Turkey (142)	0.0	**20.4**	[14.1 - 28.0]							64.1	14.1	1.4				**20.4**				
	Ground Beef (14)	0.0	**21.4**	[4.7 - 50.8]							78.6						**21.4**				
	Pork Chops (11)	0.0	**9.1**	[0.2 - 41.3]							81.8		9.1				**9.1**				
	Chickens (1280)	0.0	**14.5**	[12.6 - 16.5]							72.8	11.9	0.7	0.2		**0.1**	**14.4**				
	Turkeys (236)	0.0	**22.0**	[16.9 - 27.9]							61.9	15.3	0.4	0.4			**22.0**				
	Cattle (607)	0.0	**19.3**	[16.2 - 22.6]							67.7	12.5	0.5				**19.3**				
	Swine (308)	0.0	**16.2**	[12.3 - 20.8]							68.8	14.0	0.3	0.6			**16.2**				
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Humans (1793)	5.7	**3.7**	[2.9 - 4.7]							83.8	3.8	0.4	2.5	5.7	**0.8**	**2.9**				
	Chicken Breasts (157)	1.3	**24.8**	[18.3 - 32.4]							61.8	7.6		4.5	1.3		**24.8**				
	Ground Turkey (142)	8.5	**7.7**	[3.9 - 13.4]							71.8	8.5		3.5	8.5	**2.8**	**4.9**				
	Ground Beef (14)	0.0	**14.3**	[1.8 - 42.8]							71.4	7.1		7.1			**14.3**				
	Pork Chops (11)	18.2	**0.0**	[0.0 - 28.5]							72.7	9.1			18.2						
	Chickens (1280)	1.2	**12.4**	[10.7 - 14.4]							84.2	1.2	0.2	0.8	1.2	**0.4**	**12.0**				
	Turkeys (236)	12.7	**4.7**	[2.3 - 8.2]							73.7	4.2	0.4	4.2	12.7	**0.4**	**4.2**				
	Cattle (607)	1.6	**13.5**	[10.9 - 16.5]							78.6	2.3	1.3	2.6	1.6	**1.2**	**12.4**				
	Swine (308)	8.1	**1.9**	[0.7 - 4.2]							80.5	2.6	0.6	6.2	8.1		**1.9**				
Cephalosporins																					
Ceftiofur	Humans (1793)	0.3	**3.4**	[2.6 - 4.3]				0.6	1.5	76.2	17.6	0.4	0.3	**0.1**	**3.3**						
	Chicken Breasts (157)	0.0	**24.8**	[18.3 - 32.4]					0.6	47.1	27.4				**24.8**						
	Ground Turkey (142)	0.0	**4.9**	[2.0 - 9.9]						43.0	47.9	4.2			**4.9**						
	Ground Beef (14)	0.0	**14.3**	[1.8 - 42.8]						50.0	35.7				**14.3**						
	Pork Chops (11)	0.0	**0.0**	[0.0 - 28.5]						72.7	27.3										
	Chickens (1280)	0.3	**12.4**	[10.7 - 14.4]				0.2	2.3	76.1	8.3	0.4	0.3	**0.2**	**12.2**						
	Turkeys (236)	0.0	**4.7**	[2.3 - 8.2]						70.8	23.3	1.3			**4.7**						
	Cattle (607)	0.2	**13.3**	[10.7 - 16.3]				0.8	1.0	58.3	26.0	0.3	0.2	**0.7**	**12.7**						
	Swine (308)	0.0	**1.9**	[0.7 - 4.2]						72.7	24.7	0.6			**1.9**						
Ceftriaxone	Humans (1793)	2.6	**0.6**	[0.3 - 1.0]					96.4	0.2		0.1		0.2	1.4	1.2	**0.5**	**0.1**			
	Chicken Breasts (157)	22.9	**0.0**	[0.0 - 2.3]					75.2					1.9	18.5	4.5					
	Ground Turkey (142)	5.6	**0.0**	[0.0 - 2.6]					94.4						2.1	3.5					
	Ground Beef (14)	7.1	**7.1**	[0.2 - 33.9]					85.7							7.1	**7.1**				
	Pork Chops (11)	0.0	**0.0**	[0.0 - 28.5]					100.0												
	Chickens (1280)	10.6	**0.5**	[0.2 - 1.0]					87.4	0.1		0.2	0.2	1.1	9.5	1.1	**0.5**				
	Turkeys (236)	4.2	**0.4**	[0.0 - 2.3]					95.3						2.1	2.1	**0.4**				
	Cattle (607)	10.7	**1.3**	[0.6 - 2.6]					86.5					1.5	5.6	5.1	**0.8**	**0.5**			
	Swine (308)	1.3	**0.0**	[0.0 - 1.2]					97.7	0.3	0.3			0.3	1.0	0.3					

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[4] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 7c. Distribution of MICs and Occurrence of Resistance among all *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)	%I[1]	%R[2]	[95% CI][3]	Distribution (%) of MICs (µg/ml)[4]															
					0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Cephamycins																					
Cefoxitin	Humans (1793)	0.3	**3.5**	[2.7 - 4.4]						0.2	25.5	56.1	12.7	1.8	0.3	**1.3**	**2.1**				
	Chicken Breasts (157)	0.0	**24.8**	[18.3 - 32.4]							2.5	56.7	14.6	1.3		**5.7**	**19.1**				
	Ground Turkey (142)	1.4	**4.9**	[2.0 - 9.9]							1.4	60.6	28.2	3.5	1.4	**0.7**	**4.2**				
	Ground Beef (14)	0.0	**14.3**	[1.8 - 42.8]								50.0	14.3	21.4			**14.3**				
	Pork Chops (11)	0.0	**0.0**	[0.0 - 28.5]								81.8	18.2								
	Chickens (1280)	0.2	**12.4**	[10.7 - 14.4]							13.8	61.5	11.2	0.9	0.2	**9.6**	**2.8**				
	Turkeys (236)	0.8	**5.1**	[2.7 - 8.7]							7.2	59.3	24.2	3.4	0.8	**2.1**	**3.0**				
	Cattle (607)	0.8	**13.2**	[10.6 - 16.1]							5.8	33.4	43.5	3.3	0.8	**4.8**	**8.4**				
	Swine (308)	1.0	**1.9**	[0.7 - 4.2]						0.6	2.3	37.0	55.8	1.3	1.0	**1.3**	**0.6**				
Folate Pathway Inhibitors																					
Sulfisoxazole	Humans (1793)	N/A	**13.2**	[11.7 - 14.9]											19.3	55.7	11.5	0.2	0.1	**13.2**	
	Chicken Breasts (157)	N/A	**28.7**	[21.7 - 36.4]											12.1	14.6	43.3	1.3		**28.7**	
	Ground Turkey (142)	N/A	**28.2**	[20.9 - 36.3]											4.9	17.6	49.3			**28.2**	
	Ground Beef (14)	N/A	**14.3**	[1.8 - 42.8]											7.1	7.1	71.4			**14.3**	
	Pork Chops (11)	N/A	**18.2**	[2.3 - 51.8]												9.1	72.7			**18.2**	
	Chickens (1280)	N/A	**11.9**	[10.2 - 13.8]											48.7	35.9	3.0	0.2	0.3	**11.9**	
	Turkeys (236)	N/A	**36.4**	[30.3 - 42.9]											25.4	33.5	3.8	0.8		**36.4**	
	Cattle (607)	N/A	**22.7**	[19.5 - 26.3]											27.3	39.9	8.7	1.2	0.2	**22.7**	
	Swine (308)	N/A	**37.0**	[31.6 - 42.7]											31.5	26.0	4.5		1.0	**37.0**	
Trimethoprim-Sulfamethoxazole	Humans (1793)	N/A	**1.8**	[1.2 - 2.5]				76.4	21.0	0.6	0.1	0.2	**0.1**	**1.7**							
	Chicken Breasts (157)	N/A	**0.0**	[0.0 - 2.3]				96.8	3.2												
	Ground Turkey (142)	N/A	**0.0**	[0.0 - 2.6]				89.4	6.3	4.2											
	Ground Beef (14)	N/A	**7.1**	[0.2 - 33.9]				92.9						**7.1**							
	Pork Chops (11)	N/A	**0.0**	[0.0 - 28.5]				100.0													
	Chickens (1280)	N/A	**0.2**	[0.0 - 0.7]				84.5	15.0	0.2				**0.2**							
	Turkeys (236)	N/A	**0.8**	[0.1 - 3.0]				66.9	27.1	4.2	0.4	0.4		**0.8**							
	Cattle (607)	N/A	**1.5**	[0.7 - 2.8]				72.8	23.1	2.6			**0.2**	**1.3**							
	Swine (308)	N/A	**1.6**	[0.5 - 3.7]				63.0	31.5	3.2	0.6			**1.6**							
Phenicols																					
Chloramphenicol	Humans (1793)	0.9	**7.6**	[6.4 - 8.9]								2.1	45.1	44.3	0.9		**7.6**				
	Chicken Breasts (157)	0.6	**1.9**	[0.4 - 5.5]								2.5	14.6	80.3	0.6		**1.9**				
	Ground Turkey (142)	4.2	**2.8**	[0.8 - 7.1]									12.7	80.3	4.2		**2.8**				
	Ground Beef (14)	0.0	**14.3**	[1.8 - 42.8]									7.1	78.6			**14.3**				
	Pork Chops (11)	0.0	**18.2**	[2.3 - 51.8]										81.8			**18.2**				
	Chickens (1280)	0.5	**1.3**	[0.7 - 2.0]								5.4	54.7	38.1	0.5		**1.3**				
	Turkeys (236)	2.1	**4.7**	[2.3 - 8.2]								2.5	41.9	48.7	2.1		**4.7**				
	Cattle (607)	0.8	**17.6**	[14.7 - 20.9]								0.5	30.0	51.1	0.8	**0.2**	**17.5**				
	Swine (308)	2.9	**12.7**	[9.2 - 16.9]									19.5	64.9	2.9	**0.3**	**12.3**				

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[4] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 7d. Distribution of MICs and Occurrence of Resistance among all *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)	%I[1]	%R[2]	[95% CI][3]	Distribution (%) of MICs (µg/ml)[4] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Quinolones																					
Ciprofloxacin	Humans (1793)	0.1	**0.2**	[0.1 - 0.6]	95.8	1.4	0.1	1.1	0.9	0.4		0.1		**0.2**							
	Chicken Breasts (157)	0.0	**0.0**	[0.0 - 2.3]	96.2	3.8															
	Ground Turkey (142)	0.0	**0.0**	[0.0 - 2.6]	93.7	4.9	1.4														
	Ground Beef (14)	0.0	**0.0**	[0.0 - 23.2]	100.0																
	Pork Chops (11)	0.0	**0.0**	[0.0 - 28.5]	100.0																
	Chickens (1280)	0.0	**0.0**	[0.0 - 0.3]	98.2	1.4		0.3	0.1												
	Turkeys (236)	0.0	**0.0**	[0.0 - 1.6]	94.1	3.4	0.4		1.7	0.4											
	Cattle (607)	0.0	**0.0**	[0.0 - 0.6]	96.7	1.3	0.2	0.3	0.8	0.7											
	Swine (308)	0.0	**0.0**	[0.0 - 1.2]	96.1	3.9															
Nalidixic Acid	Humans (1793)	N/A	**2.6**	[1.9 - 3.5]						0.1	0.4	26.0	69.2	1.5	0.2	**0.2**	**2.5**				
	Chicken Breasts (157)	N/A	**0.0**	[0.0 - 2.3]								12.1	82.8	5.1							
	Ground Turkey (142)	N/A	**0.0**	[0.0 - 2.6]								4.2	85.2	9.9	0.7						
	Ground Beef (14)	N/A	**0.0**	[0.0 - 23.2]								7.1	92.9								
	Pork Chops (11)	N/A	**0.0**	[0.0 - 28.5]									100.0								
	Chickens (1280)	N/A	**0.5**	[0.2 - 1.0]							0.5	36.0	62.3	0.7		**0.1**	**0.4**				
	Turkeys (236)	N/A	**2.1**	[0.7 - 4.9]								15.3	80.5	2.1			**2.1**				
	Cattle (607)	N/A	**2.0**	[1.0 - 3.4]						0.2	0.3	13.5	82.9	1.2			**2.0**				
	Swine (308)	N/A	**0.0**	[0.0 - 1.2]								14.3	81.8	3.9							
Tetracyclines																					
Tetracycline	Humans (1793)	0.3	**13.5**	[11.9 - 15.2]									86.2	0.3	**1.4**	**4.5**	**7.6**				
	Chicken Breasts (157)	0.6	**46.5**	[38.5 - 54.6]									52.9	0.6			**46.5**				
	Ground Turkey (142)	7.7	**56.3**	[47.8 - 64.6]									35.9	7.7	**4.2**	**0.7**	**51.4**				
	Ground Beef (14)	0.0	**14.3**	[1.8 - 42.8]									85.7				**14.3**				
	Pork Chops (11)	0.0	**54.5**	[23.4 - 83.3]									45.5			**18.2**	**36.4**				
	Chickens (1280)	0.8	**27.4**	[25.0 - 30.0]									71.8	0.8	**0.2**	**0.5**	**26.6**				
	Turkeys (236)	0.0	**48.3**	[41.8 - 54.9]									51.7			**5.9**	**42.4**				
	Cattle (607)	0.2	**31.8**	[28.1 - 35.7]									68.0	0.2	**1.2**	**8.2**	**22.4**				
	Swine (308)	1.0	**58.8**	[53.0 - 64.3]									40.3	1.0	**3.2**	**14.3**	**41.2**				

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[4] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Resistance by Year

Table 8a. Antimicrobial Resistance among all *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	1324	1301	1460	1497	1377	1419	2008	1864	1793
		Chicken Breasts							60	83	157
		Ground Turkey							74	114	142
		Ground Beef							9	10	14
		Pork Chops							10	5	11
		Chickens		214	561	1438	1173	1307	1500	1158	1280
		Turkeys		107	240	713	518	550	244	262	236
		Cattle		24	284	1610	1388	893	1008	670	607
		Swine		111	793	876	451	418	379	211	308
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Aminoglycosides	Amikacin (MIC ≥ 64 µg/ml)	Humans		0.0% 0	0.0% 0	0.1% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	0.0% 0
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Gentamicin (MIC ≥ 16 µg/ml)	Humans	4.8% 63	2.9% 38	2.8% 41	2.1% 32	2.7% 37	1.9% 27	1.3% 27	1.4% 26	1.3% 24
		Chicken Breasts							10.0% 6	6.0% 5	3.8% 6
		Ground Turkey							14.9% 11	22.8% 26	20.4% 29
		Ground Beef							0.0% 0	0.0% 0	0.0% 0
		Pork Chops							30.0% 3	0.0% 0	0.0% 0
		Chickens		17.8% 38	15.3% 86	10.4% 150	14.9% 175	7.9% 103	5.5% 83	6.3% 73	4.9% 63
		Turkeys		20.6% 22	18.3% 44	17.5% 125	16.2% 84	20.9% 115	19.3% 47	21.0% 55	25.4% 60
		Cattle		0.0% 0	1.8% 5	1.6% 25	2.1% 29	2.1% 19	2.6% 26	2.7% 18	1.8% 11
		Swine		0.9% 1	0.8% 6	1.1% 10	1.3% 6	1.4% 6	0.8% 3	0.5% 1	1.3% 4
	Kanamycin (MIC ≥ 64 µg/ml)	Humans	5.0% 66	5.1% 67	5.7% 83	4.3% 65	5.6% 77	4.8% 68	3.8% 76	3.4% 64	2.8% 50
		Chicken Breasts							6.7% 4	4.8% 4	11.5% 18
		Ground Turkey							18.9% 14	27.2% 31	18.3% 26
		Ground Beef							0.0% 0	0.0% 0	0.0% 0
		Pork Chops							10.0% 1	0.0% 0	9.1% 1
		Chickens		2.3% 5	3.2% 18	1.2% 17	4.1% 48	2.4% 31	2.0% 30	2.8% 32	2.7% 34
		Turkeys		24.3% 26	17.1% 41	21.5% 153	21.4% 111	22.9% 126	24.2% 59	16.0% 42	14.4% 34
		Cattle		8.3% 2	9.5% 27	7.1% 115	6.6% 92	6.9% 62	10.1% 102	13.7% 92	8.9% 54
		Swine		11.7% 13	7.2% 57	6.7% 59	9.3% 42	6.9% 29	4.2% 16	5.7% 12	3.9% 12
	Streptomycin (MIC ≥ 64 µg/ml)	Humans	20.6% 273	21.4% 278	18.6% 272	16.8% 251	16.3% 224	17.0% 241	13.2% 265	15.0% 279	11.8% 212
		Chicken Breasts							28.3% 17	26.5% 22	28.0% 44
		Ground Turkey							37.8% 28	45.6% 52	34.5% 49
		Ground Beef							22.2% 2	40.0% 4	14.3% 2
		Pork Chops							70.0% 7	40.0% 2	27.3% 3
		Chickens		24.3% 52	27.8% 156	27.5% 396	28.6% 335	21.0% 275	22.9% 343	19.6% 227	22.2% 284
		Turkeys		34.6% 37	40.8% 98	43.6% 311	41.9% 217	46.7% 257	37.7% 92	29.4% 77	33.9% 80
		Cattle		12.5% 3	16.2% 46	15.4% 248	21.3% 296	20.3% 181	25.9% 261	28.7% 192	20.9% 127
		Swine		27.9% 31	29.4% 233	29.3% 257	39.2% 177	35.6% 149	40.1% 152	30.8% 65	36.4% 112

Table 8b. Antimicrobial Resistance among all *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	1324	1301	1460	1497	1377	1419	2008	1864	1793
		Chicken Breasts							60	83	157
		Ground Turkey							74	114	142
		Ground Beef							9	10	14
		Pork Chops							10	5	11
		Chickens		214	561	1438	1173	1307	1500	1158	1280
		Turkeys		107	240	713	518	550	244	262	236
		Cattle		24	284	1610	1388	893	1008	670	607
		Swine		111	793	876	451	418	379	211	308
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Aminopenicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	20.7% 274	18.3% 238	16.5% 241	15.6% 233	15.9% 219	17.4% 247	12.9% 259	13.6% 254	12.0% 216
		Chicken Breasts							16.7% 10	33.7% 28	30.6% 48
		Ground Turkey							16.2% 12	28.9% 33	20.4% 29
		Ground Beef							22.2% 2	40.0% 4	21.4% 3
		Pork Chops							40.0% 4	40.0% 2	9.1% 1
		Chickens		11.7% 25	12.8% 72	12.4% 179	13.0% 152	9.4% 123	14.3% 215	13.7% 159	14.5% 185
		Turkeys		12.1% 13	10.4% 25	17.7% 126	16.2% 84	19.5% 107	18.0% 44	18.7% 49	22.0% 52
		Cattle		12.5% 3	9.2% 26	12.5% 202	18.7% 259	17.9% 160	23.9% 241	28.1% 188	19.3% 117
		Swine		16.2% 18	12.9% 102	10.8% 95	18.8% 85	11.7% 49	13.7% 52	12.8% 27	16.2% 50
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	1.1% 15	1.0% 13	1.7% 25	2.3% 35	3.9% 54	4.7% 66	5.3% 106	4.6% 86	3.7% 67
		Chicken Breasts							10.0% 6	25.3% 21	24.8% 39
		Ground Turkey							12.2% 9	11.4% 13	7.7% 11
		Ground Beef							22.2% 2	40.0% 4	14.3% 2
		Pork Chops							20.0% 2	20.0% 1	0.0% 0
		Chickens		0.5% 1	2.0% 11	4.9% 70	7.3% 86	4.5% 59	10.2% 153	9.7% 112	12.4% 159
		Turkeys		4.7% 5	0.4% 1	4.3% 31	3.5% 18	6.9% 38	3.7% 9	1.5% 4	4.7% 11
		Cattle		8.3% 2	2.5% 7	3.9% 62	9.9% 138	11.8% 105	17.7% 178	21.0% 141	13.5% 82
		Swine		0.0% 0	0.4% 3	1.0% 9	1.8% 8	2.6% 11	3.7% 14	3.8% 8	1.9% 6
Cephalosporins	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	0.2% 2	0.5% 6	0.8% 12	2.0% 30	3.2% 44	4.1% 58	4.3% 87	4.5% 83	3.4% 61
		Chicken Breasts							10.0% 6	25.3% 21	24.8% 39
		Ground Turkey							8.1% 6	2.6% 3	4.9% 7
		Ground Beef							22.2% 2	40.0% 4	14.3% 2
		Pork Chops							20.0% 2	20.0% 1	0.0% 0
		Chickens		0.5% 1	2.0% 11	5.2% 75	7.6% 89	4.1% 54	10.2% 153	9.8% 113	12.4% 159
		Turkeys		3.7% 4	0.4% 1	4.6% 33	3.3% 17	5.1% 28	3.3% 8	1.5% 4	4.7% 11
		Cattle		0.0% 0	2.1% 6	4.2% 67	9.8% 136	11.4% 102	17.4% 175	21.0% 141	13.3% 81
		Swine		0.0% 0	0.1% 1	1.9% 17	1.3% 6	2.2% 9	3.2% 12	4.3% 9	1.9% 6
	Ceftriaxone (MIC ≥ 64 µg/ml)	Humans	0.0% 0	0.1% 1	0.0% 0	0.3% 5	0.0% 0	0.0% 0	0.2% 4	0.4% 8	0.6% 10
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	10.0% 1	7.1% 1
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.1% 1	0.0% 0	0.3% 5	0.1% 1	0.5% 6
		Turkeys		0.0% 0	0.0% 0	0.8% 6	0.4% 2	0.2% 1	0.0% 0	0.4% 1	0.4% 1
		Cattle		0.0% 0	0.0% 0	0.1% 1	0.1% 1	0.1% 1	0.2% 2	0.1% 1	1.3% 8
		Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0

Table 8c. Antimicrobial Resistance among all *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	1324	1301	1460	1497	1377	1419	2008	1864	1793
		Chicken Breasts							60	83	157
		Ground Turkey							74	114	142
		Ground Beef							9	10	14
		Pork Chops							10	5	11
		Chickens		214	561	1438	1173	1307	1500	1158	1280
		Turkeys		107	240	713	518	550	244	262	236
		Cattle		24	284	1610	1388	893	1008	670	607
		Swine		111	793	876	451	418	379	211	308
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Cephalosporins	Cephalothin (MIC ≥ 32 µg/ml)	Humans	2.9% 39	2.2% 29	2.3% 33	3.6% 54	4.0% 55	4.0% 57	5.0% 101	5.4% 100	
		Chicken Breasts							13.3% 8	28.9% 24	
		Ground Turkey							14.9% 11	28.9% 33	
		Ground Beef							22.2% 2	40.0% 4	
		Pork Chops							20.0% 2	40.0% 2	
		Chickens		1.4% 3	4.5% 25	5.8% 83	7.8% 91	4.7% 62	10.5% 158	10.4% 121	
		Turkeys		5.6% 6	5.0% 12	10.5% 75	8.3% 43	13.1% 72	9.8% 24	11.1% 29	
		Cattle		0.0% 0	2.1% 6	4.7% 76	9.9% 137	11.6% 104	17.7% 178	21.2% 142	
		Swine		0.0% 0	0.1% 1	0.8% 7	2.4% 11	2.2% 9	3.2% 12	3.8% 8	
Cephamycins	Cefoxitin (MIC ≥ 32 µg/ml)	Humans					3.2% 44	3.4% 48	4.3% 86	4.2% 79	3.5% 62
		Chicken Breasts							10.0% 6	25.3% 21	24.8% 39
		Ground Turkey							8.1% 6	2.6% 3	4.9% 7
		Ground Beef							22.2% 2	40.0% 4	14.3% 2
		Pork Chops							20.0% 2	20.0% 1	0.0% 0
		Chickens					7.2% 85	4.1% 53	8.7% 130	8.2% 95	12.4% 159
		Turkeys					3.3% 17	4.5% 25	2.5% 6	1.1% 3	5.1% 12
		Cattle					9.1% 126	11.1% 99	15.9% 160	17.8% 119	13.2% 80
		Swine					1.3% 6	2.2% 9	2.9% 11	4.3% 9	1.9% 6
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole[1] (MIC ≥ 512 µg/ml)	Humans	20.3% 269	22.8% 297	19.4% 283	18.0% 270	17.1% 235	17.7% 251	12.8% 258	15.0% 280	13.2% 237
		Chicken Breasts							16.7% 10	14.5% 12	28.7% 45
		Ground Turkey							20.3% 15	33.3% 38	28.2% 40
		Ground Beef							22.2% 2	40.0% 4	14.3% 2
		Pork Chops							70.0% 7	40.0% 2	18.2% 2
		Chickens		24.8% 53	23.7% 133	15.9% 229	18.4% 216	11.8% 154	8.9% 133	10.3% 119	11.9% 152
		Turkeys		37.4% 40	32.1% 77	36.0% 257	25.1% 130	38.0% 209	30.3% 74	28.2% 74	36.4% 86
		Cattle		20.8% 5	15.5% 44	15.0% 242	19.9% 276	19.7% 176	22.3% 225	25.1% 168	22.7% 138
		Swine		34.2% 38	29.0% 230	30.7% 269	35.7% 161	34.9% 146	34.6% 131	25.1% 53	37.0% 114
	Trimethoprim-Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	3.9% 51	1.8% 24	2.3% 34	2.1% 31	2.1% 29	2.0% 28	1.4% 28	1.9% 36	1.8% 32
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							1.4% 1	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	7.1% 1
		Pork Chops							20.0% 2	0.0% 0	0.0% 0
		Chickens		0.5% 1	1.2% 7	1.1% 16	0.4% 5	0.5% 6	0.8% 12	0.3% 4	0.2% 3
		Turkeys		3.7% 4	2.5% 6	4.2% 30	1.5% 8	2.5% 14	2.5% 6	2.3% 6	0.8% 2
		Cattle		4.2% 1	2.5% 7	2.4% 39	2.2% 30	2.6% 23	2.5% 25	3.3% 22	1.5% 9
		Swine		1.8% 2	0.3% 2	1.1% 10	0.9% 4	0.0% 0	1.6% 6	2.4% 5	1.6% 5

[1] Sulfamethoxazole was tested from 1996 to 2003 and was replaced by sulfisoxazole in 2004

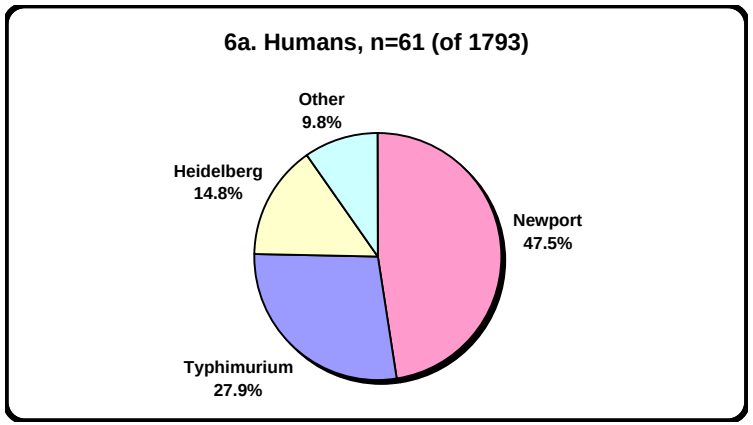
Table 8d. Antimicrobial Resistance among all *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

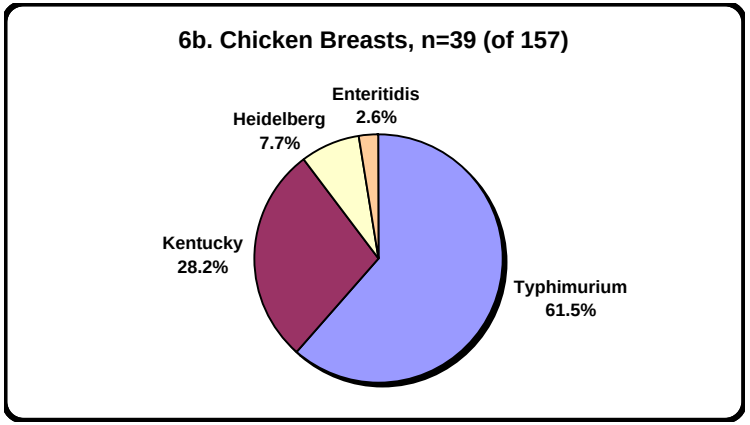
Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	1324	1301	1460	1497	1377	1419	2008	1864	1793
		Chicken Breasts							60	83	157
		Ground Turkey							74	114	142
		Ground Beef							9	10	14
		Pork Chops							10	5	11
		Chickens		214	561	1438	1173	1307	1500	1158	1280
		Turkeys		107	240	713	518	550	244	262	236
		Cattle		24	284	1610	1388	893	1008	670	607
		Swine		111	793	876	451	418	379	211	308
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Phenicols	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	10.6% 140	10.1% 131	9.9% 145	9.2% 138	10.1% 139	11.6% 164	8.6% 172	10.0% 187	7.6% 136
		Chicken Breasts							0.0% 0	2.4% 2	1.9% 3
		Ground Turkey							1.4% 1	0.9% 1	2.8% 4
		Ground Beef							22.2% 2	40.0% 4	14.3% 2
		Pork Chops							40.0% 4	40.0% 2	18.2% 2
		Chickens		2.3% 5	2.9% 16	1.8% 26	4.6% 54	2.5% 33	2.4% 36	2.1% 24	1.3% 16
		Turkeys		3.7% 4	0.8% 2	4.1% 29	4.1% 21	3.8% 21	5.3% 13	4.2% 11	4.7% 11
		Cattle		4.2% 1	5.6% 16	8.5% 137	15.1% 209	16.5% 147	20.6% 208	25.1% 168	17.6% 107
		Swine		11.7% 13	8.4% 67	8.0% 70	12.4% 56	7.7% 32	10.0% 38	8.5% 18	12.7% 39
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	0.0% 0	0.0% 0	0.1% 1	0.1% 1	0.4% 5	0.2% 3	<0.1% 1	0.2% 3	0.2% 4
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	0.0% 0
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.1% 1	0.0% 0
		Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	0.4% 5	0.9% 12	1.4% 20	1.0% 15	2.5% 34	2.6% 37	1.8% 36	2.3% 42	2.6% 47
		Chicken Breasts							0.0% 0	1.2% 1	0.0% 0
		Ground Turkey							8.1% 6	4.4% 5	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	0.0% 0
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		0.0% 0	0.2% 1	0.2% 3	0.5% 6	0.0% 0	0.8% 12	0.4% 5	0.5% 6
		Turkeys		4.7% 5	2.1% 5	5.3% 38	5.4% 28	5.1% 28	5.3% 13	3.8% 10	2.1% 5
		Cattle		0.0% 0	0.4% 1	0.1% 1	0.4% 6	0.4% 4	0.4% 4	0.4% 3	2.0% 12
		Swine		0.0% 0	0.0% 0	0.0% 0	0.2% 1	0.0% 0	0.3% 1	0.0% 0	0.0% 0
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	24.2% 320	21.7% 282	20.2% 295	19.4% 290	18.6% 256	19.7% 280	14.9% 299	16.3% 303	13.5% 242
		Chicken Breasts							33.3% 20	27.7% 23	46.5% 73
		Ground Turkey							55.4% 41	39.5% 45	56.3% 80
		Ground Beef							22.2% 2	40.0% 4	14.3% 2
		Pork Chops							70.0% 7	80.0% 4	54.5% 6
		Chickens		20.6% 44	20.5% 115	25.0% 359	26.3% 308	21.9% 286	24.9% 374	26.2% 303	27.4% 351
		Turkeys		52.3% 56	45.8% 110	52.9% 377	56.2% 291	54.9% 302	54.5% 133	58.8% 154	48.3% 114
		Cattle		25.0% 6	24.3% 69	20.9% 336	25.8% 358	26.3% 235	32.0% 323	36.9% 247	31.8% 193
		Swine		52.3% 58	47.5% 377	48.4% 424	54.3% 245	53.1% 222	57.8% 219	43.1% 91	58.8% 181

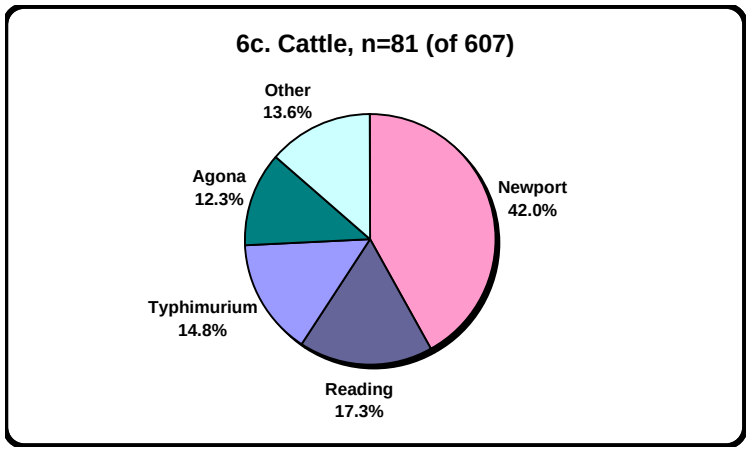
Table 9. Ceftiofur-Resistant *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, by Source and Serotype, 2004

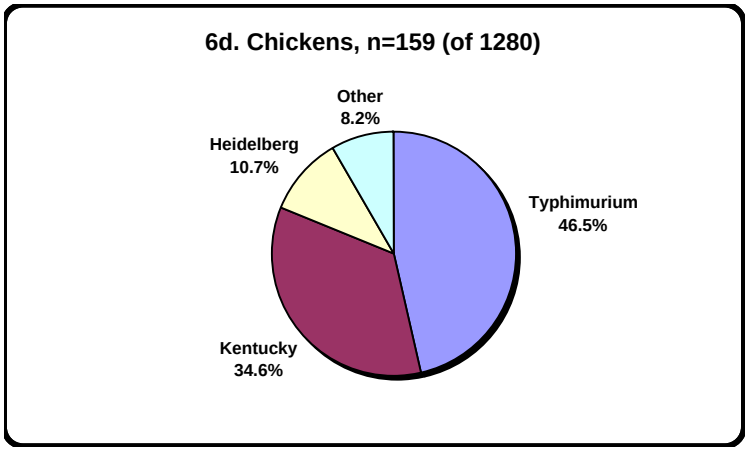
Humans				Retail Meats				Food Animals			
Source	**Serotype**	**n**	**%**	**Meat Type**	**Serotype**	**n**	**%**	**Animal Source**	**Serotype**	**n**	**%**
Humans (n=61)	Newport	29	47.5	**Chicken Breasts (n=39)**	Typhimurium	24	61.5	**Chickens (n=159)**	Typhimurium	74	46.5
	Typhimurium	17	27.9		Kentucky	11	28.2		Kentucky	55	34.6
	Heidelberg	9	14.8		Heidelberg	3	7.7		Heidelberg	17	10.7
	I 4,[5],12:i:-	1	1.6		Enteritidis	1	2.6		I 4,[5],12:r:-	4	2.5
	Agona	1	1.6						I 4,[5],12:i:-	2	1.3
	Anatum	1	1.6						Schwarzengrund	2	1.3
	Dublin	1	1.6						I 4,12:nonmotile	1	0.6
	Uganda	1	1.6						Braenderup	1	0.6
	Incomplete Serotype	1	1.6						Cerro	1	0.6
									Enteritidis	1	0.6
									Thompson	1	0.6
				Ground Turkey (n=7)	Derby	2	28.6	**Turkeys (n=11)**	Heidelberg	3	27.3
					Heidelberg	2	28.6		Typhimurium	2	18.2
					Agona	1	14.3		I 3,10:nonmotile	1	9.1
					Bredeney	1	14.3		I 4,12:r:-	1	9.1
					Saintpaul	1	14.3		Alachua	1	9.1
									Berta	1	9.1
									Newport	1	9.1
									Reading	1	9.1
				Ground Beef (n=2)	Newport	2	100.0	**Cattle (n=81)**	Newport	34	42.0
									Reading	14	17.3
									Typhimurium	12	14.8
									Agona	10	12.3
									Dublin	4	4.9
									Saintpaul	2	2.5
									I 9,12:nonmotile	1	1.2
									Anatum	1	1.2
									Heidelberg	1	1.2
									Ohio	1	1.2
									Uganda	1	1.2
				Pork Chops (n=0)				**Swine (n=6)**	Reading	2	33.3
									Agona	1	16.7
									Derby	1	16.7
									Thompson	1	16.7
									Typhimurium	1	16.7

Figures 6a-d. Ceftiofur-Resistant *Salmonella* (non-Typhi) Isolates, by Source[1] and Serotype, 2004









[1] Pie charts are not provided for other sources due to the small number of ceftiofur-resistant isolates (11 from turkeys, 7 from ground turkey, 6 from swine, 2 from ground beef, and none from pork chops). Table 9 shows a complete listing of ceftiofur-resistant isolates by source and serotype

Figure 7. Percent of *Salmonella* (non-Typhi) Isolates from Humans, Retail Poultry, and Poultry Resistant to Ceftiofur, by Year, 1996-2004

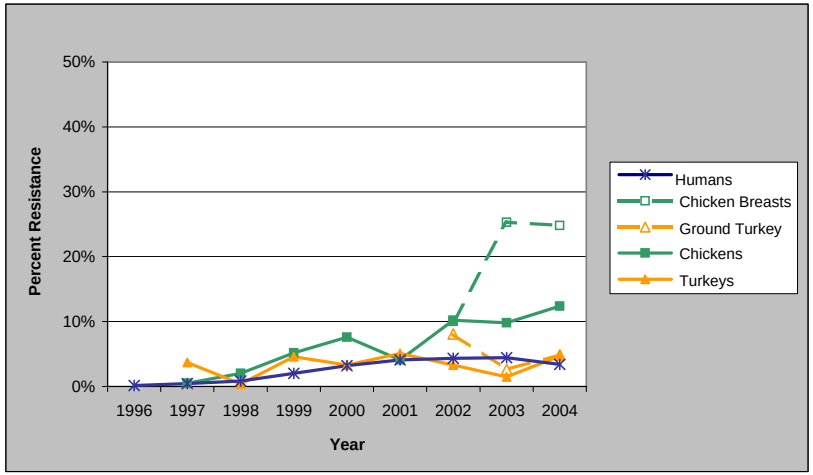


Figure 8. Percent of *Salmonella* (non-Typhi) Isolates from Humans, Ground Beef, Pork Chops, Cattle, and Swine Resistant to Ceftiofur, by Year, 1996-2004

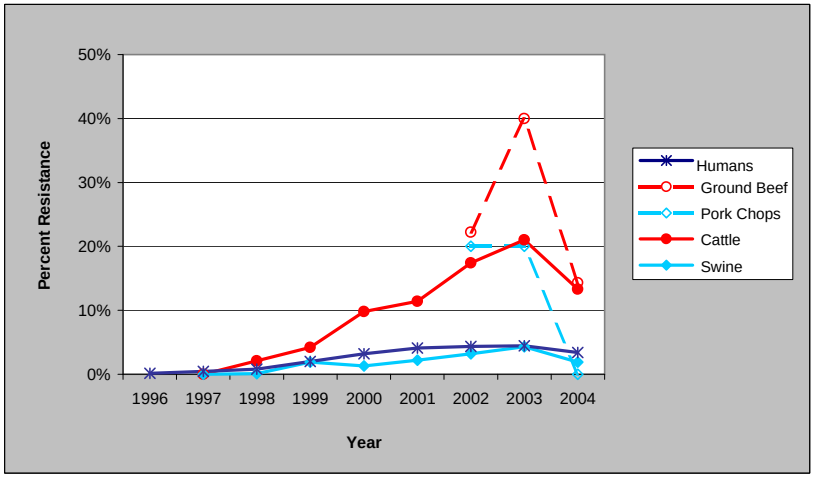


Table 10. Number of *Salmonella* (non-Typhi) Isolates Tested from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

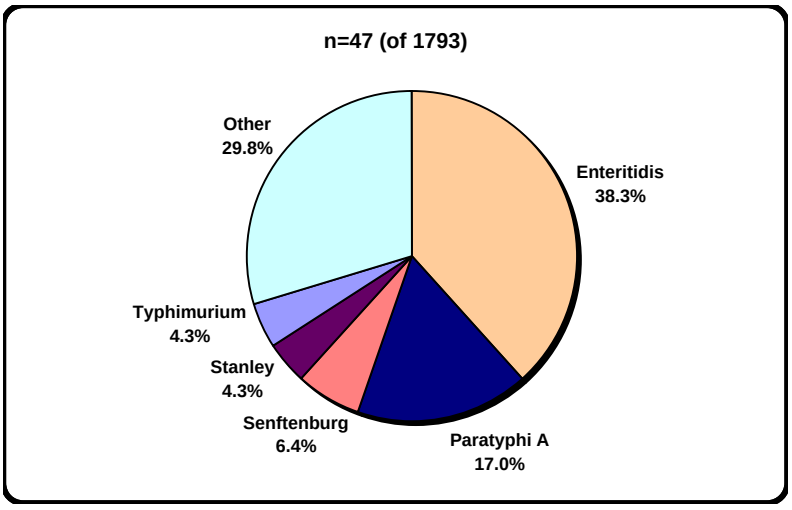
	1996	1997	1998	1999	2000	2001	2002	2003	2004
Humans	1324	1301	1460	1497	1377	1419	2008	1864	1793
Chicken Breasts							60	83	157
Ground Turkey							74	114	142
Ground Beef							9	10	14
Pork Chops							10	5	11
Chickens		214	561	1438	1173	1307	1500	1158	1280
Turkeys		107	240	713	518	550	244	262	236
Cattle		24	284	1610	1388	893	1008	670	607
Swine		111	793	876	451	418	379	211	308

Nalidixic Acid Resistance

Table 11. Naldixic Acid-Resistant *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, by Source and Serotype, 2004

Humans				Retail Meats				Food Animals			
Source	**Serotype**	**n**	**%**	**Meat Type**	**Serotype**	**n**	**%**	**Animal Source**	**Serotype**	**n**	**%**
Humans (n=47)	Enteritidis	18	38.3	**Chicken Breasts (n=0)**				**Chickens (n=6)**	Schwarzengrund	2	33.3
	Paratyphi A	8	17.0						I 4,[5],12:i:-	1	16.7
	Senftenburg	3	6.4						Braenderup	1	16.7
	Stanley	2	4.3						Kentucky	1	16.7
	Typhimurium	2	4.3						Montevideo	1	16.7
	I 4,[5],12:i:-	1	2.1								
	Agona	1	2.1								
	Choleraesuis	1	2.1								
	Derby	1	2.1								
	Durban	1	2.1								
	Hadar	1	2.1								
	Infantis	1	2.1								
	Javiana	1	2.1								
	Kentucky	1	2.1	**Ground Turkey (n=0)**				**Turkeys (n=5)**	Typhimurium	2	40.0
	Montevideo	1	2.1						Bredeney	1	20.0
	Newport	1	2.1						Hadar	1	20.0
	Saintpaul	1	2.1						Saintpaul	1	20.0
	Uganda	1	2.1								
	Incomplete Serotype	1	2.1	**Ground Beef (n=0)**				**Cattle (n=12)**	Dublin	3	25.0
									Typhimurium	3	25.0
									Agona	2	16.7
									Reading	2	16.7
									Mbandaka	1	8.3
									Uganda	1	8.3
				Pork Chops (n=0)				**Swine (n=0)**			

Figure 9. Nalidixic Acid-Resistant *Salmonella* (non-Typhi) Isolates from Humans,[1] by Serotype, 2004



[1] Pie charts are not provided for other sources due to the small number of nalidixic acid-resistant isolates (12 from cattle, 6 from chickens, 5 from turkeys, and none from swine and retail meats). Table 11 shows a complete listing of nalidixic acid-resistant isolates by source and serotype

Figure 10. Percent of *Salmonella* (non-Typhi) Isolates from Humans, Retail Poultry, and Poultry Resistant to Nalidixic Acid, by Year, 1996-2004

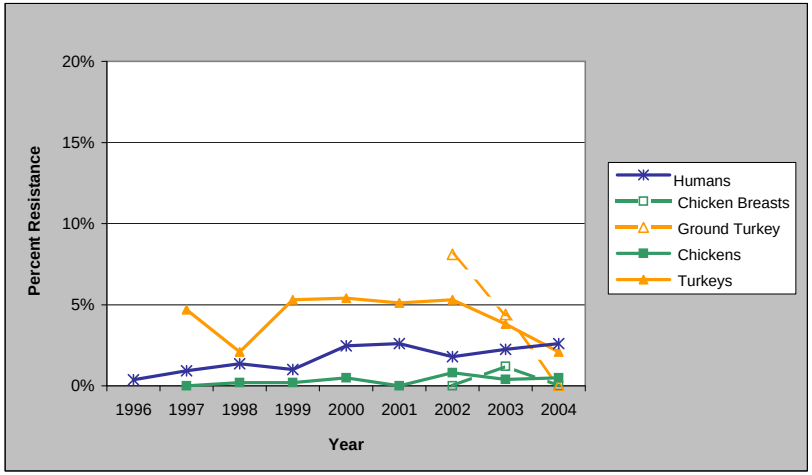


Figure 11. Percent of *Salmonella* (non-Typhi) Isolates from Humans, Ground Beef, Pork Chops, Cattle, and Swine Resistant to Nalidixic Acid, by Year, 1996-2004

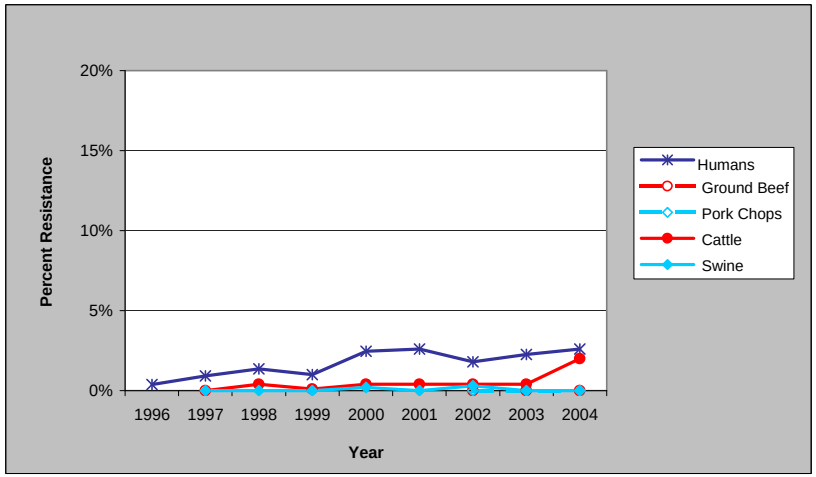


Table 12. Number of *Salmonella* (non-Typhi) Isolates Tested from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Humans	1324	1301	1460	1497	1377	1419	2008	1864	1793
Chicken Breasts							60	83	157
Ground Turkey							74	114	142
Ground Beef							9	10	14
Pork Chops							10	5	11
Chickens		214	561	1438	1173	1307	1500	1158	1280
Turkeys		107	240	713	518	550	244	262	236
Cattle		24	284	1610	1388	893	1008	670	607
Swine		111	793	876	451	418	379	211	308

Multidrug Resistance

Table 13a. Resistance Patterns among all *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year		1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested	Humans	1324	1301	1460	1497	1377	1419	2008	1864	1793
	Chicken Breasts							60	83	157
	Ground Turkey							74	114	142
	Ground Beef							9	10	14
	Pork Chops							10	5	11
	Chickens		214	561	1438	1173	1307	1500	1158	1280
	Turkeys		107	240	713	518	550	244	262	236
	Cattle		24	284	1610	1388	893	1008	670	607
	Swine		111	793	876	451	418	379	211	308
Resistance Pattern	**Isolate Source**									
1. No Resistance Detected	Humans	66.2% 876	68.4% 890	72.9% 1064	74.1% 1109	74.4% 1024	72.3% 1026	79.0% 1586	77.7% 1449	79.6% 1427
	Chicken Breasts							51.7% 31	47.0% 39	40.1% 63
	Ground Turkey							37.8% 28	34.2% 39	28.9% 41
	Ground Beef							77.8% 7	60.0% 6	78.6% 11
	Pork Chops							20.0% 2	20.0% 1	45.5% 5
	Chickens		52.8% 113	58.6% 329	58.8% 846	56.9% 667	66.5% 869	62.0% 930	61.1% 708	62.7% 803
	Turkeys		32.7% 35	41.3% 99	32.5% 232	33.4% 173	31.6% 174	29.9% 73	24.0% 63	33.5% 79
	Cattle		66.7% 16	73.2% 208	74.5% 1199	70.0% 972	69.9% 624	64.3% 648	61.0% 409	65.6% 398
	Swine		44.1% 49	49.2% 390	48.9% 428	43.2% 195	43.3% 181	40.1% 152	53.6% 113	37.3% 115
2. At Least ACSSuT[1] Resistant	Humans	8.8% 116	9.5% 124	8.9% 130	8.4% 126	8.9% 122	10.0% 142	7.8% 156	9.3% 173	7.1% 128
	Chicken Breasts							0.0% 0	2.4% 2	1.9% 3
	Ground Turkey							1.4% 1	0.9% 1	2.8% 4
	Ground Beef							22.2% 2	40.0% 4	14.3% 2
	Pork Chops							40.0% 4	40.0% 2	9.1% 1
	Chickens		1.4% 3	2.7% 15	1.7% 24	4.3% 50	2.4% 32	1.9% 29	1.5% 17	0.9% 12
	Turkeys		3.7% 4	0.8% 2	3.8% 27	3.3% 17	3.6% 20	4.5% 11	2.3% 6	4.7% 11
	Cattle		4.2% 1	4.2% 12	7.6% 123	13.1% 182	14.6% 130	17.1% 172	18.1% 121	16.3% 99
	Swine		4.5% 5	7.8% 62	7.1% 62	8.6% 39	7.2% 30	7.7% 29	7.6% 16	12.0% 37
3. At Least ACT/S[2] Resistant	Humans	0.8% 10	0.4% 5	0.9% 13	1.0% 15	1.0% 14	0.5% 7	1.0% 21	1.2% 23	0.6% 10
	Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
	Ground Turkey							1.4% 1	0.0% 0	0.0% 0
	Ground Beef							0.0% 0	0.0% 0	7.1% 1
	Pork Chops							20.0% 2	0.0% 0	0.0% 0
	Chickens		0.0% 0	0.2% 1	0.1% 2	0.0% 0	0.1% 1	0.0% 0	0.0% 0	0.1% 1
	Turkeys		0.0% 0	0.4% 1	0.4% 3	0.8% 4	0.7% 4	0.8% 2	0.0% 0	0.4% 1
	Cattle		0.0% 0	2.1% 6	2.2% 35	1.7% 23	2.4% 21	2.4% 24	2.7% 18	1.2% 7
	Swine		0.0% 0	0.5% 4	0.5% 4	0.0% 0	1.0% 4	0.5% 2	0.9% 2	0.6% 2

[1] ACSSuT = ampicillin, chloramphenicol, streptomycin, sulfamethoxazole/sulfisoxazole, and tetracycline

[2] ACT/S = ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole

Table 13b. Resistance Patterns among all *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year		1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested	Humans	1324	1301	1460	1497	1377	1419	2008	1864	1793
	Chicken Breasts							60	83	157
	Ground Turkey							74	114	142
	Ground Beef							9	10	14
	Pork Chops							10	5	11
	Chickens		214	561	1438	1173	1307	1500	1158	1280
	Turkeys		107	240	713	518	550	244	262	236
	Cattle		24	284	1610	1388	893	1008	670	607
	Swine		111	793	876	451	418	379	211	308
Resistance Pattern	**Isolate Source**									
4. At Least ACSSuTAuCf[1] Resistant	Humans	0.0% 0	0.3% 4	0.3% 5	1.5% 23	2.6% 36	2.5% 36	3.3% 67	3.2% 60	2.3% 42
	Chicken Breasts							0.0% 0	0.0% 0	1.9% 3
	Ground Turkey							1.4% 1	0.9% 1	2.1% 3
	Ground Beef							22.2% 2	40.0% 4	14.3% 2
	Pork Chops							20.0% 2	20.0% 1	0.0% 0
	Chickens		0.0% 0	0.5% 3	0.3% 5	2.7% 32	1.1% 14	0.9% 13	1.0% 12	0.4% 5
	Turkeys		3.7% 4	0.4% 1	3.4% 24	1.9% 10	2.9% 16	1.6% 4	0.8% 2	2.1% 5
	Cattle		0.0% 0	2.1% 6	3.7% 59	8.9% 124	11.0% 98	14.6% 147	15.1% 101	11.9% 72
	Swine		0.0% 0	0.1% 1	0.6% 5	1.3% 6	2.2% 9	1.8% 7	1.9% 4	1.0% 3
5. At Least Ceftiofur and Nalidixic Acid Resistant	Humans	0.0% 0	0.2% 2	0.0% 0	0.1% 1	0.1% 1	0.1% 2	0.2% 4	0.1% 2	0.1% 2
	Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
	Ground Turkey							0.0% 0	0.9% 1	0.0% 0
	Ground Beef							0.0% 0	0.0% 0	0.0% 0
	Pork Chops							0.0% 0	0.0% 0	0.0% 0
	Chickens		0.0% 0	0.0% 0	0.1% 1	0.1% 1	0.0% 0	0.6% 9	0.1% 1	0.2% 3
	Turkeys		1.9% 2	0.0% 0	2.7% 19	1.2% 6	1.5% 8	1.2% 3	0.4% 1	0.8% 2
	Cattle		0.0% 0	0.0% 0	0.1% 1	0.1% 1	0.3% 3	0.2% 2	0.4% 3	1.0% 6
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.3% 1	0.0% 0	0.0% 0

[1] ACSSuTAuCf = ACSSuT, amoxicillin-clavulanic acid, and ceftiofur

Table 14. *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals that are at least ACSSuT[1] Resistant, by Serotype, 2004

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (n=128)	Typhimurium	89	69.5	Chicken Breasts (n=3)	Typhimurium	2	66.7	Chickens (n=12)	Heidelberg	4	33.3
	Newport	28	21.9		Heidelberg	1	33.3		Kentucky	3	25.0
	Java	2	1.6						Typhimurium	3	25.0
	I 4,[5],12:i:-	1	0.8						I 4,[5],12:r:-	1	8.3
	Agona	1	0.8						Thompson	1	8.3
	Anatum	1	0.8								
	Dublin	1	0.8	Ground Turkey (n=4)	Heidelberg	2	50.0	Turkeys (n=11)	Typhimurium	4	36.4
	Enteritidis	1	0.8		Saintpaul	1	25.0		Senftenberg	3	27.3
	Heidelberg	1	0.8		Typhimurium	1	25.0		I 4,12:r:-	1	9.1
	Uganda	1	0.8						IIIa 18:z4,z23:-	1	9.1
	Incomplete Serotyping	1	0.8						Alachua	1	9.1
	Unknown	1	0.8						Newport	1	9.1
				Ground Beef (n=2)	Newport	2	100.0	Cattle (n=99)	Newport	33	33.3
									Typhimurium	26	26.2
									Reading	14	14.1
									Dublin	12	12.1
									Agona	10	10.1
									Anatum	1	1.0
									Heidelberg	1	1.0
									Ohio	1	1.0
									Uganda	1	1.0
				Pork Chops (n=1)	Typhimurium	1	100.0	Swine (n=37)	Typhimurium	32	86.5
									Reading	2	5.4
									Agona	1	2.7
									Derby	1	2.7
									Krefeld	1	2.7

[1] ACSSuT = ampicillin, chloramphenicol, streptomycin, sulfamethoxazole/sulfisoxazole, and tetracycline

Table 15. *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals that are at least ACT/S[1] Resistant, by Serotype, 2004

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (n=10)	Typhimurium	6	60.0	Chicken Breasts (n=0)				Chickens (n=1)	Kentucky	1	100.0
	Newport	2	20.0								
	Agona	1	10.0								
	Dublin	1	10.0								
				Ground Turkey (n=0)				Turkeys (n=1)	Newport	1	100.0
				Ground Beef (n=1)	Newport	1	100.0	Cattle (n=7)	Agona	3	42.9
									Typhimurium	2	28.6
									Heidelberg	1	14.3
									Newport	1	14.3
				Pork Chops (n=0)				Swine (n=2)	Typhimurium	1	50.0
									Agona	1	50.0

[1] ACT/S = ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole

Table 16. *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals that are at least ACSSuTAuCf[1] Resistant, by Serotype, 2004

Humans				Retail Meats				Food Animals			
Source	**Serotype**	**n**	**%**	**Meat Type**	**Serotype**	**n**	**%**	**Animal Source**	**Serotype**	**n**	**%**
Humans (n=42)	Newport	28	66.7	**Chicken Breasts (n=3)**	Typhimurium	2	66.7	**Chickens (n=5)**	Heidelberg	4	80.0
	Typhimurium	10	23.8		Heidelberg	1	33.3		I 4,[5],12:r:-	1	10.0
	Agona	1	2.4								
	Anatum	1	2.4								
	Uganda	1	2.4								
	Incomplete Serotyping	1	2.4								
				Ground Turkey (n=3)	Heidelberg	2	66.7	**Turkeys (n=5)**	Typhimurium	2	40.0
					Saintpaul	1	33.3		I 4,12:r:-	1	20.0
									Alachua	1	20.0
									Newport	1	20.0
				Ground Beef (n=2)	Newport	2	100.0	**Cattle (n=72)**	Newport	32	44.4
									Reading	14	19.4
									Agona	10	13.9
									Typhimurium	10	13.9
									Dublin	2	2.8
									Anatum	1	1.4
									Heidelberg	1	1.4
									Ohio	1	1.4
									Uganda	1	1.4
				Pork Chops (n=0)				**Swine (n=3)**	Reading	2	66.7
									Agona	1	33.3

[1] ACSSuTAuCf = ACSSuT, amoxicillin-clavulanic acid, and ceftiofur

Table 17. *Salmonella* (non-Typhi) Isolates from Humans, Retail Meats, and Food Animals that are at least Ceftiofur and Nalidixic Acid Resistant, by Serotype, 2004

Humans				Retail Meats				Food Animals			
Source	**Serotype**	**n**	**%**	**Meat Type**	**Serotype**	**n**	**%**	**Animal Source**	**Serotype**	**n**	**%**
Humans (n=2)	Newport	1	50.0	**Chicken Breasts (n=0)**				**Chickens (n=3)**	I 4,[5],12:i:-	1	33.3
	Uganda	1	50.0						Braenderup	1	33.3
									Kentucky	1	33.3
				Ground Turkey (n=0)				**Turkeys (n=2)**	Typhimurium	2	100.0
				Ground Beef (n=0)				**Cattle (n=6)**	Reading	2	33.3
									Typhimurium	2	33.3
									Agona	1	16.7
									Uganda	1	16.7
				Pork Chops (n=0)				**Swine (n=0)**			

E. Antimicrobial Susceptibility among *Salmonella* Typhimurium

MIC Distributions

Table 18a. Distribution of MICs and Occurrence of Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Aminoglycosides																					
Amikacin	Humans (382)	0.0	**0.0**	[0.0 - 1.0]						1.8	74.3	21.7	2.1								
	Chicken Breasts (49)	0.0	**0.0**	[0.0 - 7.3]						20.4	49.0	28.6	2.0								
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]						50.0	50.0										
	Pork Chops (2)	0.0	**0.0**	[0.0 - 84.2]							100.0										
	Chickens (171)	0.0	**0.0**	[0.0 - 2.1]						32.7	57.3	9.4	0.6								
	Turkeys (14)	0.0	**0.0**	[0.0 - 23.2]							92.9	7.1									
	Cattle (48)	0.0	**0.0**	[0.0 - 7.4]						2.1	75.0	20.8	2.1								
	Swine (53)	0.0	**0.0**	[0.0 - 6.7]						3.8	69.8	20.8	5.7								
Gentamicin	Humans (382)	0.0	**2.1**	[0.9 - 4.1]					64.1	32.5	1.0	0.3			**0.5**	**1.6**					
	Chicken Breasts (49)	0.0	**2.0**	[0.1 - 10.9]					71.4	22.4	4.1				**2.0**						
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]					50.0	50.0											
	Pork Chops (2)	0.0	**0.0**	[0.0 - 84.2]						100.0											
	Chickens (171)	0.0	**4.1**	[1.7 - 8.3]					74.9	20.5	0.6				**2.9**	**1.2**					
	Turkeys (14)	0.0	**64.3**	[35.1 - 87.2]					28.6	7.1					**50.0**	**14.3**					
	Cattle (48)	0.0	**0.0**	[0.0 - 7.4]					62.5	35.4	2.1										
	Swine (53)	0.0	**3.8**	[0.5 - 13.0]					47.2	49.1					**3.8**						
Kanamycin	Humans (382)	0.0	**5.8**	[3.6 - 8.6]										93.7	0.5		**0.3**	**5.5**			
	Chicken Breasts (49)	0.0	**34.7**	[21.7 - 49.6]										65.3				**34.7**			
	Ground Turkey (2)	0.0	**50.0**	[1.3 - 98.7]										50.0				**50.0**			
	Pork Chops (2)	0.0	**0.0**	[0.0 - 84.2]										100.0							
	Chickens (171)	0.0	**9.9**	[5.9 - 15.4]										90.1				**9.9**			
	Turkeys (14)	0.0	**21.4**	[4.7 - 50.8]										78.6				**21.4**			
	Cattle (48)	0.0	**14.6**	[6.1 - 27.8]										85.4				**14.6**			
	Swine (53)	0.0	**9.4**	[3.1 - 20.7]										90.6				**9.4**			
Streptomycin	Humans (382)	N/A	**31.7**	[27.0 - 36.6]												68.3	**20.4**	**11.3**			
	Chicken Breasts (49)	N/A	**14.3**	[5.9 - 27.2]												85.7	**4.1**	**10.2**			
	Ground Turkey (2)	N/A	**50.0**	[1.3 - 98.7]												50.0	**50.0**				
	Pork Chops (2)	N/A	**100.0**	[15.8 - 100.0]														**100.0**			
	Chickens (171)	N/A	**8.2**	[4.5 - 13.4]												91.8	**4.7**	**3.5**			
	Turkeys (14)	N/A	**64.3**	[35.1 - 87.2]												35.7	**42.9**	**21.4**			
	Cattle (48)	N/A	**56.3**	[41.2 - 70.5]												43.8	**27.1**	**29.2**			
	Swine (53)	N/A	**77.4**	[63.8 - 87.7]												22.6	**41.5**	**35.8**			

[1] There were no *Salmonella* Typhimurium isolates from ground beef

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 18b. Distribution of MICs and Occurrence of Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (14) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Aminopenicillins																					
Ampicillin	Humans (382)	0.0	**31.9**	[27.3 - 36.9]							43.2	23.3	1.6				**31.9**				
	Chicken Breasts (49)	0.0	**53.1**	[38.3 - 67.5]							44.9	2.0					**53.1**				
	Ground Turkey (2)	0.0	**50.0**	[1.3 - 98.7]							50.0						**50.0**				
	Pork Chops (2)	0.0	**50.0**	[1.3 - 98.7]									50.0				**50.0**				
	Chickens (171)	0.0	**46.8**	[39.1 - 54.6]							45.0	7.6	0.6			**0.6**	**46.2**				
	Turkeys (14)	0.0	**28.6**	[8.4 - 58.1]							64.3	7.1					**28.6**				
	Cattle (48)	0.0	**60.4**	[45.3 - 74-2]							35.4	2.1	2.1				**60.4**				
	Swine (53)	0.0	**71.7**	[57.7 - 83.2]							18.9	7.5		1.9			**71.7**				
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Humans (382)	21.2	**4.7**	[2.8 - 7.3]							66.2	2.1		5.8	21.2	**0.3**	**4.5**				
	Chicken Breasts (49)	0.0	**49.0**	[34.4 - 63.7]							40.8	6.1		4.1			**49.0**				
	Ground Turkey (2)	50.0	**0.0**	[0.0 - 84.2]							50.0				50.0						
	Pork Chops (2)	50.0	**0.0**	[0.0 - 84.2]											100.0						
	Chickens (171)	1.2	**43.3**	[35.7 - 51.1]							52.0	1.2		2.3	1.2		**43.3**				
	Turkeys (14)	14.3	**14.3**	[1.8 - 42.8]							64.3	7.1			14.3		**14.3**				
	Cattle (48)	16.7	**25.0**	[13.6 - 39.6]							35.4	4.2		18.8	16.7		**25.0**				
	Swine (53)	45.3	**0.0**	[0.0 - 6.7]							24.5	3.8		26.4	45.3						
Cephalosporins																					
Ceftiofur	Humans (382)	0.0	**4.5**	[2.6 - 7.0]				0.3	1.0	77.2	16.2	0.8			**4.5**						
	Chicken Breasts (49)	0.0	**49.0**	[34.4 - 63.7]						38.8	12.2				**49.0**						
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]						50.0	50.0										
	Pork Chops (2)	0.0	**0.0**	[0.0 - 84.2]						50.0	50.0										
	Chickens (171)	0.0	**43.3**	[35.7 - 51.1]					0.6	50.3	5.8			**0.6**	**42.7**						
	Turkeys (14)	0.0	**14.3**	[1.8 - 42.8]						71.4	14.3				**14.3**						
	Cattle (48)	0.0	**25.0**	[13.6 - 39.6]						66.7	6.2	2.1		**2.1**	**22.9**						
	Swine (53)	0.0	**1.9**	[0.0 - 10.1]						77.4	17.0	3.8			**1.9**						
Ceftriaxone	Humans (382)	3.4	**0.8**	[0.2 - 2.3]					95.5					0.3	2.9	0.5	**0.8**				
	Chicken Breasts (49)	49.0	**0.0**	[0.0 - 7.3]					51.0						34.7	14.3					
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]					100.0												
	Pork Chops (2)	0.0	**0.0**	[0.0 - 84.2]					100.0												
	Chickens (171)	40.4	**1.8**	[0.4 - 5.0]					56.7					1.2	36.3	4.1	**1.8**				
	Turkeys (14)	14.3	**0.0**	[0.0 - 23.2]					85.7						7.1	7.1					
	Cattle (48)	20.8	**2.1**	[0.1 - 11.1]					75.0					2.1	12.5	8.3	**2.1**				
	Swine (53)	0.0	**0.0**	[0.0 - 6.7]					98.1	1.9											

[1] There were no *Salmonella* Typhimurium isolates from ground beef

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 18c. Distribution of MICs and Occurrence of Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (14) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Cephamycins																					
Cefoxitin	Humans (382)	0.3	**4.7**	[2.8 - 7.3]						0.3	19.6	66.2	6.5	2.4	0.3	**2.6**	**2.1**				
	Chicken Breasts (49)	0.0	**49.0**	[34.4 - 63.7]							4.1	36.7	10.2				**49.0**				
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]								100.0									
	Pork Chops (2)	0.0	**0.0**	[0.0 - 84.2]								100.0									
	Chickens (171)	0.0	**43.3**	[35.7 - 51.1]							5.3	45.6	4.7	1.2		**29.8**	**13.5**				
	Turkeys (14)	0.0	**14.3**	[1.8 - 42.8]								85.7				**7.1**	**7.1**				
	Cattle (48)	2.1	**25.0**	[13.6 - 39.6]							6.2	62.5	4.2		2.1	**12.5**	**12.5**				
	Swine (53)	3.8	**0.0**	[0.0 - 6.7]						1.9	5.7	69.8	18.9		3.8						
Folate Pathway Inhibitors																					
Sulfisoxazole	Humans (382)	N/A	**35.9**	[31.0 - 40.9]											11.8	49.2	2.9	0.3		**35.9**	
	Chicken Breasts (49)	N/A	**73.5**	[58.9 - 85.1]											2.0	10.2	14.3			**73.5**	
	Ground Turkey (2)	N/A	**100.0**	[15.8 - 100.0]																**100.0**	
	Pork Chops (2)	N/A	**100.0**	[15.8 - 100.0]																**100.0**	
	Chickens (171)	N/A	**47.4**	[39.7 - 55.1]											31.6	18.7	1.8		0.6	**47.4**	
	Turkeys (14)	N/A	**78.6**	[49.2 - 95.3]											14.3	7.1				**78.6**	
	Cattle (48)	N/A	**60.4**	[45.3 - 74.2]											22.9	16.7				**60.4**	
	Swine (53)	N/A	**81.1**	[68.0 - 90.6]											7.5	11.3				**81.1**	
Trimethoprim-Sulfamethoxazole	Humans (382)	N/A	**2.6**	[1.3 - 4.8]				63.4	33.5	0.3	0.3			**2.6**							
	Chicken Breasts (49)	N/A	**0.0**	[0.0 - 7.3]				93.9	6.1												
	Ground Turkey (2)	N/A	**0.0**	[0.0 - 84.2]				100.0													
	Pork Chops (2)	N/A	**0.0**	[0.0 - 84.2]				100.0													
	Chickens (171)	N/A	**0.0**	[0.0 - 2.1]				63.2	35.7	1.2											
	Turkeys (14)	N/A	**0.0**	[0.0 - 23.2]				50.0	50.0												
	Cattle (48)	N/A	**4.2**	[0.5 - 14.3]				45.8	43.8	6.2				**4.2**							
	Swine (53)	N/A	**1.9**	[0.0 - 10.1]				24.5	58.5	11.3	3.8			**1.9**							
Phenicols																					
Chloramphenicol	Humans (382)	0.3	**24.1**	[19.9 - 28.7]								1.8	38.2	35.6	0.3		**24.1**				
	Chicken Breasts (49)	0.0	**4.1**	[0.5 - 14.0]									12.2	83.7			**4.1**				
	Ground Turkey (2)	0.0	**50.0**	[1.3 - 98.7]									50.0				**50.0**				
	Pork Chops (2)	0.0	**100.0**	[15.8 - 100.0]													**100.0**				
	Chickens (171)	0.0	**1.8**	[0.4 - 5.0]								0.6	46.2	51.5			**1.8**				
	Turkeys (14)	0.0	**28.6**	[8.4 - 58.1]								7.1	21.4	42.9			**28.6**				
	Cattle (48)	2.1	**54.2**	[39.2 - 68.6]									18.8	25.0	2.1		**54.2**				
	Swine (53)	7.5	**60.4**	[46.0 - 73.5]									3.8	28.3	7.5	**1.9**	**58.5**				

[1] There were no *Salmonella* Typhimurium isolates from ground beef

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 18d. Distribution of MICs and Occurrence of Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (14) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Quinolones																					
Ciprofloxacin	Humans (382)	0.0	**0.0**	[0.0 - 1.0]	97.9	1.3		0.5	0.3												
	Chicken Breasts (49)	0.0	**0.0**	[0.0 - 7.3]	95.9	4.1															
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]	100.0																
	Pork Chops (2)	0.0	**0.0**	[0.0 - 84.2]	100.0																
	Chickens (171)	0.0	**0.0**	[0.0 - 2.1]	100.0																
	Turkeys (14)	0.0	**0.0**	[0.0 - 23.2]	85.7				14.3												
	Cattle (48)	0.0	**0.0**	[0.0 - 7.4]	93.8		2.1	2.1		2.1											
	Swine (53)	0.0	**0.0**	[0.0 - 6.7]	88.7	11.3															
Nalidixic Acid	Humans (382)	N/A	**0.5**	[0.1 - 1.9]							0.5	24.6	72.8	1.3	0.3		**0.5**				
	Chicken Breasts (49)	N/A	**0.0**	[0.0 - 7.3]								4.1	89.8	6.1							
	Ground Turkey (2)	N/A	**0.0**	[0.0 - 84.2]									100.0								
	Pork Chops (2)	N/A	**0.0**	[0.0 - 84.2]									100.0								
	Chickens (171)	N/A	**0.0**	[0.0 - 2.1]								8.2	90.1	1.8							
	Turkeys (14)	N/A	**14.3**	[1.8 - 42.8]								7.1	78.6				**14.3**				
	Cattle (48)	N/A	**6.3**	[1.3 - 17.2]								10.4	83.3				**6.3**				
	Swine (53)	N/A	**0.0**	[0.0 - 6.7]								9.4	77.4	13.2							
Tetracyclines																					
Tetracycline	Humans (382)	0.0	**30.1**	[25.5 - 35.0]									69.9		**5.2**	**15.2**	**9.7**				
	Chicken Breasts (49)	0.0	**71.4**	[56.7 - 83.4]									28.6				**71.4**				
	Ground Turkey (2)	0.0	**100.0**	[15.8 - 100.0]												**50.0**	**50.0**				
	Pork Chops (2)	0.0	**100.0**	[15.8 - 100.0]												**100.0**					
	Chickens (171)	0.0	**44.4**	[36.9 - 52.2]									55.6		**0.6**	**1.2**	**42.7**				
	Turkeys (14)	0.0	**78.6**	[49.2 - 95.3]									21.4			**14.3**	**64.3**				
	Cattle (48)	0.0	**60.4**	[45.3 - 74.2]									39.6		**6.2**	**27.1**	**27.1**				
	Swine (53)	0.0	**90.6**	[79.3 - 96.9]									9.4		**15.1**	**32.1**	**43.4**				

[1] There were no *Salmonella* Typhimurium isolates from ground beef

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Resistance by Year

Table 19a. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	306	328	378	362	303	325	393	404	382
		Chicken Breasts							9	22	49
		Ground Turkey							2	2	2
		Ground Beef							2	1	0
		Pork Chops							2	1	2
		Chickens		24	66	154	145	130	150	156	171
		Turkeys		11	6	37	18	15	9	6	14
		Cattle		2	33	189	187	87	98	78	48
		Swine		25	105	114	81	44	48	27	53
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Aminoglycosides	Amikacin (MIC ≥ 64 µg/ml)	Humans		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Gentamicin (MIC ≥ 16 µg/ml)	Humans	4.2% 13	4.6% 15	3.7% 14	2.2% 8	2.6% 8	1.5% 5	2.3% 9	2.0% 8	2.1% 8
		Chicken Breasts							0.0% 0	0.0% 0	2.0% 1
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		20.8% 5	18.2% 12	16.9% 26	15.2% 22	3.1% 4	12.7% 19	5.1% 8	4.1% 7
		Turkeys		45.5% 5	50.0% 3	29.7% 11	33.3% 6	53.3% 8	44.4% 4	83.3% 5	64.3% 9
		Cattle		0.0% 0	3.0% 1	2.6% 5	1.6% 3	0.0% 0	2.0% 2	1.3% 1	0.0% 0
		Swine		0.0% 0	0.0% 0	1.8% 2	0.0% 0	2.3% 1	2.1% 1	0.0% 0	3.8% 2
	Kanamycin (MIC ≥ 64 µg/ml)	Humans	14.4% 44	15.5% 51	15.9% 60	13.0% 47	13.2% 40	8.3% 27	7.6% 30	7.2% 29	5.8% 22
		Chicken Breasts							0.0% 0	18.2% 4	34.7% 17
		Ground Turkey							0.0% 0	50.0% 1	50.0% 1
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		8.3% 2	4.5% 3	3.9% 6	3.4% 5	3.1% 4	5.3% 8	7.7% 12	9.9% 17
		Turkeys		81.8% 9	66.7% 4	59.5% 22	44.4% 8	73.3% 11	55.6% 5	50.0% 3	21.4% 3
		Cattle		0.0% 0	54.5% 18	36.5% 69	27.3% 51	24.1% 21	26.5% 26	16.7% 13	14.6% 7
		Swine		16.0% 4	18.1% 19	21.1% 24	14.8% 12	13.6% 6	2.1% 1	0.0% 0	9.4% 5
	Streptomycin (MIC ≥ 64 µg/ml)	Humans	51.6% 158	55.2% 181	47.4% 179	43.1% 156	39.3% 119	40.0% 130	31.8% 125	34.9% 141	31.7% 121
		Chicken Breasts							0.0% 0	18.2% 4	14.3% 7
		Ground Turkey							0.0% 0	50.0% 1	50.0% 1
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							50.0% 1	100.0% 1	100.0% 2
		Chickens		41.7% 10	45.5% 30	40.9% 63	35.9% 52	16.9% 22	30.0% 45	16.7% 26	8.2% 14
		Turkeys		81.8% 9	83.3% 5	81.1% 30	72.2% 13	93.3% 14	77.8% 7	100.0% 6	64.3% 9
		Cattle		100.0% 2	57.6% 19	63.0% 119	63.1% 118	46.0% 40	66.3% 65	52.6% 41	56.3% 27
		Swine		44.0% 11	82.9% 87	80.7% 92	77.8% 63	70.5% 31	77.1% 37	59.3% 16	77.4% 41

Table 19b. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	306	328	378	362	303	325	393	404	382
		Chicken Breasts							9	22	49
		Ground Turkey							2	2	2
		Ground Beef							2	1	0
		Pork Chops							2	1	2
		Chickens		24	66	154	145	130	150	156	171
		Turkeys		11	6	37	18	15	9	6	14
		Cattle		2	33	189	187	87	98	78	48
		Swine		25	105	114	81	44	48	27	53
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Aminopenicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	50.0% 153	50.3% 165	45.2% 171	41.2% 149	41.9% 127	42.5% 138	33.6% 132	35.6% 144	31.9% 122
		Chicken Breasts							33.3% 3	72.7% 16	53.1% 26
		Ground Turkey							0.0% 0	100.0% 2	50.0% 1
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							50.0% 1	100.0% 1	50.0% 1
		Chickens		33.3% 8	30.3% 20	43.5% 67	42.1% 61	26.2% 34	45.3% 68	32.1% 50	46.8% 80
		Turkeys		72.7% 8	50.0% 3	64.9% 24	66.7% 12	80.0% 12	55.6% 5	66.7% 4	28.6% 4
		Cattle		100.0% 2	57.6% 19	66.1% 125	63.1% 118	57.5% 50	71.4% 70	59.0% 46	60.4% 29
		Swine		72.0% 18	75.2% 79	64.0% 73	82.7% 67	63.6% 28	62.5% 30	51.9% 14	71.7% 38
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	2.6% 8	3.4% 11	4.5% 17	2.8% 10	6.3% 19	6.2% 20	7.6% 30	5.4% 22	4.7% 18
		Chicken Breasts							33.3% 3	63.6% 14	49.0% 24
		Ground Turkey							0.0% 0	100.0% 2	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		0.0% 0	9.1% 6	29.2% 45	25.5% 37	14.6% 19	28.7% 43	25.6% 40	43.3% 74
		Turkeys		63.6% 7	0.0% 0	51.4% 19	38.9% 7	53.3% 8	22.2% 2	16.7% 1	14.3% 2
		Cattle		50.0% 1	6.1% 2	6.9% 13	12.8% 24	13.8% 12	17.3% 17	20.5% 16	25.0% 12
		Swine		0.0% 0	1.9% 2	1.8% 2	2.5% 2	4.5% 2	8.3% 4	0.0% 0	0.0% 0
Cephalosporins	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	0.0% 0	1.5% 5	1.9% 7	1.9% 7	3.6% 11	3.1% 10	4.3% 17	5.0% 20	4.5% 17
		Chicken Breasts							33.3% 3	63.6% 14	49.0% 24
		Ground Turkey							0.0% 0	100.0% 2	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		0.0% 0	9.1% 6	29.9% 46	26.2% 38	14.60% 19	28.0% 42	25.6% 40	43.3% 74
		Turkeys		63.6% 7	0.0% 0	48.6% 18	38.9% 7	53.3% 8	22.2% 2	16.7% 1	14.3% 2
		Cattle		0.0% 0	3.0% 1	6.9% 13	11.8% 22	11.5% 10	15.3% 15	20.5% 16	25.0% 12
		Swine		0.0% 0	0.0% 0	1.8% 2	0.0% 0	0.0% 0	4.2% 2	0.0% 0	1.9% 1
	Ceftriaxone (MIC ≥ 64 µg/ml)	Humans	0.0% 0	0.3% 1	0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.3% 1	0.2% 1	0.8% 3
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.3% 2	0.0% 0	1.8% 3
		Turkeys		0.0% 0	0.0% 0	8.1% 3	11.1% 2	6.7% 1	0.0% 0	16.7% 1	0.0% 0
		Cattle		0.0% 0	0.0% 0	0.5% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.1% 1
		Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0

Table 19c. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

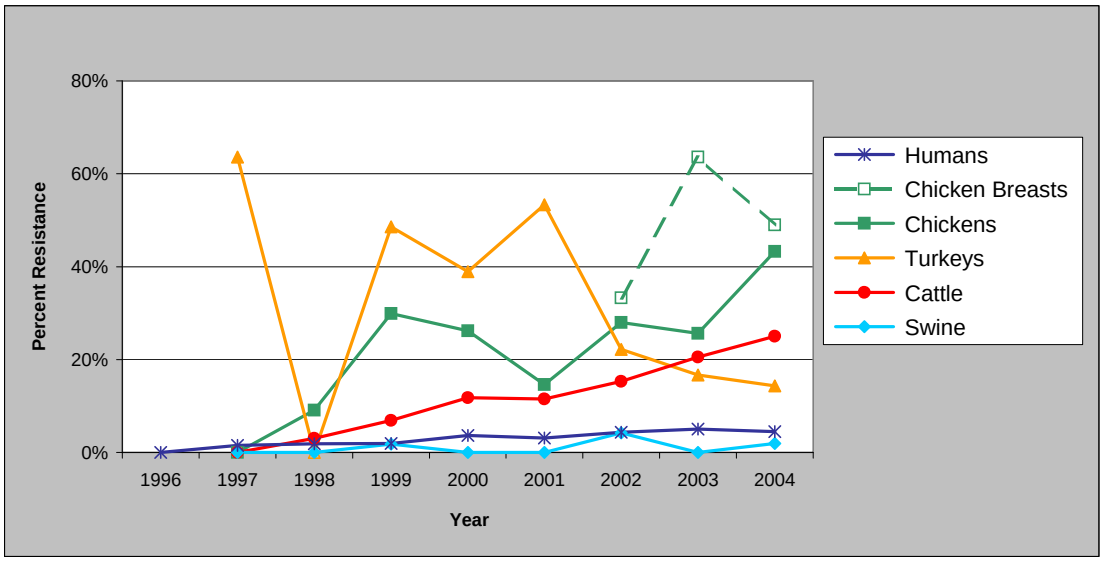
Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	306	328	378	362	303	325	393	404	382
		Chicken Breasts							9	22	49
		Ground Turkey							2	2	2
		Ground Beef							2	1	0
		Pork Chops							2	1	2
		Chickens		24	66	154	145	130	150	156	171
		Turkeys		11	6	37	18	15	9	6	14
		Cattle		2	33	189	187	87	98	78	48
		Swine		25	105	114	81	44	48	27	53
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Cephalosporins	Cephalothin (MIC ≥ 32 µg/ml)	Humans	2.0% 6	4.3% 14	4.0% 15	4.4% 16	4.3% 13	3.1% 10	5.6% 22	6.2% 25	
		Chicken Breasts							33.3% 3	63.6% 14	
		Ground Turkey							0.0% 0	100.0% 2	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							0.0% 0	100.0% 1	
		Chickens		0.0% 0	9.1% 6	29.9% 46	25.5% 37	13.8% 18	28.0% 42	25.6% 40	
		Turkeys		63.6% 7	50.0% 3	51.4% 19	38.9% 7	60.0% 9	22.2% 2	33.3% 2	
		Cattle		0.0% 0	3.0% 1	13.2% 25	12.8% 24	12.6% 11	16.3% 16	21.8% 17	
		Swine		0.0% 0	0.0% 0	0.9% 1	2.5% 2	0.0% 0	4.2% 2	0.0% 0	
Cephamycins	Cefoxitin (MIC ≥ 32 µg/ml)	Humans					3.6% 11	3.1% 10	4.3% 17	4.5% 18	4.7% 18
		Chicken Breasts							33.3% 3	63.6% 14	49.0% 24
		Ground Turkey							0.0% 0	100.0% 2	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens					24.8% 36	14.6% 19	26.7% 40	23.7% 37	43.3% 74
		Turkeys					38.9% 7	53.3% 8	22.2% 2	16.7% 1	14.3% 2
		Cattle					9.1% 17	11.5% 10	11.2% 11	16.7% 13	25.0% 12
		Swine					12.1% 1	0.0% 0	4.2% 2	3.7% 1	0.0% 0
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole[1] (MIC ≥ 512 µg/ml)	Humans	53.3% 163	56.7% 186	49.7% 188	45.6% 165	45.2% 137	43.1% 140	31.2% 126	38.2% 154	35.9% 137
		Chicken Breasts							44.4% 4	31.8% 7	73.5% 36
		Ground Turkey							0.0% 0	50.0% 1	100.0% 2
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							50.0% 1	100.0% 1	100.0% 2
		Chickens		41.7% 10	37.9% 25	32.5% 50	34.5% 50	18.5% 24	31.3% 47	28.2% 44	47.4% 81
		Turkeys		81.8% 9	83.3% 5	75.7% 28	66.7% 12	86.7% 13	77.8% 7	100.0% 6	78.6% 11
		Cattle		100.0% 2	60.6% 20	64.6% 122	64.2% 120	54.0% 47	58.2% 57	44.9% 35	60.4% 29
		Swine		80.0% 20	83.8% 88	78.9% 90	86.4% 70	75.0% 33	68.8% 33	63.0% 17	81.1% 43
	Trimethoprim-Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	4.6% 14	3.0% 10	4.5% 17	2.8% 10	3.6% 11	2.5% 8	2.3% 9	3.5% 14	2.6% 10
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		0.0% 0	1.5% 1	1.3% 2	0.0% 0	0.8% 1	13.0% 2	0.6% 1	0.0% 0
		Turkeys		0.0% 0	0.0% 0	0.0% 0	11.1% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle		0.0% 0	6.1% 2	9.0% 17	2.1% 4	2.3% 2	4.1% 4	2.6% 2	4.2% 2
		Swine		4.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.1% 1	3.7% 1	1.9% 1

[1] Sulfamethoxazole was tested from 1996 to 2003 and was replaced by sulfisoxazole in 2004

Table 19d. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	306	328	378	362	303	325	393	404	382
		Chicken Breasts							9	22	49
		Ground Turkey							2	2	2
		Ground Beef							2	1	0
		Pork Chops							2	1	2
		Chickens		24	66	154	145	130	150	156	171
		Turkeys		11	6	37	18	15	9	6	14
		Cattle		2	33	189	187	87	98	78	48
		Swine		25	105	114	81	44	48	27	53
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Phenicols	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	39.9% 122	36.0% 118	33.6% 127	28.7% 104	30.7% 93	31.7% 103	23.2% 91	27.5% 111	24.1% 92
		Chicken Breasts							0.0% 0	9.1% 2	4.1% 2
		Ground Turkey							0.0% 0	50.0% 1	50.0% 1
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							50.0% 1	100.0% 1	100.0% 2
		Chickens		20.8% 5	19.7% 13	10.4% 16	14.5% 21	11.5% 15	16.0% 24	5.1% 8	1.8% 3
		Turkeys		63.6% 7	0.0% 0	54.1% 20	55.6% 10	73.3% 11	66.7% 6	50.0% 3	28.6% 4
		Cattle		100.0% 2	27.3% 9	37.0% 70	42.8% 80	37.9% 33	49.0% 48	42.3% 33	54.2% 26
		Swine		52.0% 13	57.1% 60	49.1% 56	53.1% 43	47.7% 21	56.3% 27	48.1% 13	60.4% 32
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	0.3% 1	0.9% 3	0.5% 2	0.0% 0	1.3% 4	0.6% 2	1.3% 5	1.2% 5	0.5% 2
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	50.0% 1	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							0.0% 0	0.0% 0	0.0% 0
		Chickens		0.0% 0	0.0% 0	6.0% 1	7.0% 1	0.0% 0	2.7% 4	0.0% 0	0.0% 0
		Turkeys		45.5% 5	0.0% 0	51.4% 19	33.3% 6	60.0% 9	55.6% 5	33.3% 2	14.3% 2
		Cattle		0.0% 0	0.0% 0	0.5% 1	0.0% 0	0.0% 0	1.0% 1	0.0% 0	6.3% 3
		Swine		0.0% 0	0.0% 0	0.0% 0	1.2% 1	0.0% 0	2.1% 1	0.0% 0	0.0% 0
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	49.3% 151	52.4% 172	46.0% 174	41.7% 151	43.2% 131	43.4% 141	31.8% 125	37.6% 152	30.1% 115
		Chicken Breasts							44.4% 4	31.8% 7	71.4% 35
		Ground Turkey							0.0% 0	50.0% 1	100.0% 2
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops							100.0% 2	100.0% 1	100.0% 2
		Chickens		33.3% 8	31.8% 21	32.5% 50	32.4% 47	16.2% 21	28.0% 42	33.3% 52	44.4% 76
		Turkeys		90.9% 10	83.3% 5	78.4% 29	83.3% 15	93.3% 14	77.8% 7	100.0% 6	78.6% 11
		Cattle		100.0% 2	63.6% 21	58.7% 111	61.5% 115	44.8% 39	64.3% 63	53.8% 42	60.4% 29
		Swine		84.0% 21	89.5% 94	84.2% 96	91.1% 73	79.5% 35	89.6% 43	74.1% 20	90.6% 48

Figure 12. Percent of *Salmonella* Typhimurium Isolates from Humans, Retail Chicken Breasts,[1] and Food Animals Resistant to Ceftiofur, by Year, 1996-2004



[1] Data for ground turkey, ground beef, and pork chops are not included due to the small number of *Salmonella* Typhimurium isolates from these sources. Table 19 contains resistance data for *Salmonella* Typhimurium isolates from each source, by year

Table 20. Number of *Salmonella* Typhimurium Isolates Tested from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Humans	306	328	378	362	303	325	393	404	382
Chicken Breasts							9	22	49
Ground Turkey							2	2	2
Ground Beef							2	1	0
Pork Chops							2	1	2
Chickens		24	66	154	145	130	150	156	171
Turkeys		11	6	37	18	15	9	6	14
Cattle		2	33	189	187	87	98	78	48
Swine		25	105	114	81	44	48	27	53

Table 21a. Resistance Patterns among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year		1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested	Humans	306	328	378	362	303	325	393	404	382
	Chicken Breasts							9	22	49
	Ground Turkey							2	2	2
	Ground Beef							2	1	0
	Pork Chops							2	1	2
	Chickens		24	66	154	145	130	150	156	171
	Turkeys		11	6	37	18	15	9	6	14
	Cattle		2	33	189	187	87	98	78	48
	Swine		25	105	114	81	44	48	27	53
Resistance Pattern	**Isolate Source**									
1. No Resistance Detected	Humans	37.9% 116	39.0% 128	46.8% 177	50.6% 183	49.5% 150	49.2% 160	60.3% 237	55.2% 223	60.7% 232
	Chicken Breasts							22.2% 2	22.7% 5	14.3% 7
	Ground Turkey							100.0% 2	0.0% 0	0.0% 0
	Ground Beef							100.0% 2	100.0% 1	
	Pork Chops							0.0% 0	0.0% 0	0.0% 0
	Chickens		37.5% 9	39.4% 26	29.2% 45	32.4% 47	64.6% 84	37.3% 56	45.5% 71	40.9% 70
	Turkeys		0.0% 0	16.7% 1	10.8% 4	5.6% 1	6.7% 1	0.0% 0	0.0% 0	14.3% 2
	Cattle		0.0% 0	36.4% 12	29.1% 55	26.7% 50	34.5% 30	19.4% 19	39.7% 31	35.4% 17
	Swine		12.0% 3	7.6% 8	7.9% 9	2.5% 2	13.6% 6	8.3% 4	18.5% 5	3.8% 2
2. At Least ACSSuT[1] Resistant	Humans	33.7% 103	35.1% 115	32.0% 121	27.6% 100	27.7% 84	29.5% 96	21.4% 84	25.7% 104	23.3% 89
	Chicken Breasts							0.0% 0	9.1% 2	4.1% 2
	Ground Turkey							0.0% 0	50.0% 1	50.0% 1
	Ground Beef							0.0% 0	0.0% 0	
	Pork Chops							50.0% 1	100.0% 1	50.0% 1
	Chickens		12.5% 3	16.7% 11	9.7% 15	13.1% 19	11.5% 15	12.7% 19	3.2% 5	1.8% 3
	Turkeys		27.3% 3	0.0% 0	51.4% 19	50.0% 9	66.7% 10	44.4% 4	50.0% 3	28.6% 4
	Cattle		50.0% 1	21.2% 7	32.8% 62	37.4% 70	31.0% 27	31.6% 31	28.2% 22	54.2% 26
	Swine		20.0% 5	54.3% 57	46.5% 53	39.5% 32	45.5% 20	47.9% 23	44.4% 12	60.4% 32
3. At Least ACT/S[2] Resistant	Humans	2.0% 6	0.6% 2	2.6% 10	2.2% 8	1.7% 5	0.9% 3	2.0% 8	3.2% 13	1.6% 6
	Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
	Ground Turkey							0.0% 0	0.0% 0	0.0% 0
	Ground Beef							0.0% 0	0.0% 0	
	Pork Chops							0.0% 0	0.0% 0	0.0% 0
	Chickens		0.0% 0	0.0% 0	0.6% 1	0.7% 1	0.0% 0	2.7% 4	0.0% 0	0.0% 0
	Turkeys		18.2% 2	0.0% 0	48.6% 18	33.3% 6	53.3% 8	22.2% 2	16.7% 1	0.0% 0
	Cattle		0.0% 0	0.0% 0	0.5% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	4.2% 2
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.1% 1	0.0% 0	1.9% 1

[1] ACSSuT = ampicillin, chloramphenicol, streptomycin, sulfamethoxazole/sulfisoxazole, and tetracycline

[2] ACT/S = ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole

Table 21b. Resistance Patterns among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year		1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested	Humans	306	328	378	362	303	325	393	404	382
	Chicken Breasts							9	22	49
	Ground Turkey							2	2	2
	Ground Beef							2	1	0
	Pork Chops							2	1	2
	Chickens		24	66	154	145	130	150	156	171
	Turkeys		11	6	37	18	15	9	6	14
	Cattle		2	33	189	187	87	98	78	48
	Swine		25	105	114	81	44	48	27	53
Resistance Pattern	**Isolate Source**									
4. At Least ACSSuTAuCf[1] Resistant	Humans	0.0% 0	1.2% 4	1.1% 4	0.6% 2	2.0% 6	1.2% 4	1.8% 7	2.2% 9	2.6% 10
	Chicken Breasts							0.0% 0	0.0% 0	4.1% 2
	Ground Turkey							0.0% 0	50.0% 1	0.0% 0
	Ground Beef							0.0% 0	0.0% 0	
	Pork Chops							0.0% 0	0.0% 0	0.0% 0
	Chickens		0.0% 0	0.0% 0	0.6% 1	0.7% 1	0.0% 0	2.0% 3	0.6% 1	0.0% 0
	Turkeys		27.3% 3	0.0% 0	45.9% 17	33.3% 6	53.3% 8	11.1% 1	16.7% 1	14.3% 2
	Cattle		0.0% 0	3.0% 1	6.3% 12	11.8% 22	10.3% 9	11.2% 11	12.8% 10	20.8% 10
	Swine		0.0% 0	0.0% 0	1.8% 2	0.0% 0	0.0% 0	4.2% 2	0.0% 0	0.0% 0
5. At Least Ceftiofur and Nalidixic Acid Resistant	Humans	0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.3% 1	0.3% 1	0.5% 2	0.0% 0	0.3% 1
	Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
	Ground Turkey							0.0% 0	50.0% 1	0.0% 0
	Ground Beef							0.0% 0	0.0% 0	
	Pork Chops							0.0% 0	0.0% 0	0.0% 0
	Chickens		0.0% 0	0.0% 0	0.6% 1	0.7% 1	0.0% 0	2.7% 4	0.0% 0	0.0% 0
	Turkeys		18.2% 2	0.0% 0	48.6% 18	33.3% 6	53.3% 8	22.2% 2	16.7% 1	14.3% 2
	Cattle		0.0% 0	0.0% 0	0.5% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	4.2% 2
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.1% 1	0.0% 0	0.0% 0

[1] ACSSuTAuCf = ACSSuT, amoxicillin-clavulanic acid, and ceftiofur

F. Antimicrobial Susceptibility among *Salmonella* Enteritidis

MIC Distributions

Table 22a. Distribution of MICs and Occurrence of Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Aminoglycosides																					
Amikacin	Humans (271)	0.0	**0.0**	[0.0 - 1.4]						23.6	64.9	9.2	2.2								
	Chicken Breasts (3)	0.0	**0.0**	[0.0 - 70.8]							100.0										
	Chickens (84)	0.0	**0.0**	[0.0 - 4.3]						45.2	51.2	3.6									
	Cattle (2)	0.0	**0.0**	[0.0 - 84.2]							50.0	50.0									
	Swine (1)	0.0	**0.0**	[0.0 - 97.5]						100.0											
Gentamicin	Humans (271)	0.0	**0.4**	[0.0 - 2.0]					85.2	12.9	1.1		0.4			**0.4**					
	Chicken Breasts (3)	0.0	**0.0**	[0.0 - 70.8]						100.0											
	Chickens (84)	0.0	**1.2**	[0.0 - 6.5]					89.3	9.5					**1.2**						
	Cattle (2)	0.0	**0.0**	[0.0 - 84.2]						100.0											
	Swine (1)	0.0	**0.0**	[0.0 - 97.5]					100.0												
Kanamycin	Humans (271)	0.0	**0.7**	[0.1 - 2.6]										99.3				**0.7**			
	Chicken Breasts (3)	0.0	**0.0**	[0.0 - 70.8]										100.0							
	Chickens (84)	0.0	**0.0**	[0.0 - 4.3]										100.0							
	Cattle (2)	0.0	**0.0**	[0.0 - 84.2]										100.0							
	Swine (1)	0.0	**0.0**	[0.0 - 97.5]										100.0							
Streptomycin	Humans (271)	N/A	**2.2**	[0.8 - 4.8]												97.8	**1.5**	**0.7**			
	Chicken Breasts (3)	N/A	**0.0**	[0.0 - 70.8]												100.0					
	Chickens (84)	N/A	**1.2**	[0.0 - 6.5]												98.8	**1.2**				
	Cattle (2)	N/A	**0.0**	[0.0 - 84.2]												100.0					
	Swine (1)	N/A	**0.0**	[0.0 - 97.5]												100.0					
Aminopenicillins																					
Ampicillin	Humans (271)	0.0	**4.1**	[2.0 - 7.1]							57.2	38.4	0.4			**0.4**	**3.7**				
	Chicken Breasts (3)	0.0	**33.3**	[0.8 - 90.6]								66.7					**33.3**				
	Chickens (84)	0.0	**1.2**	[0.0 - 6.5]							81.0	15.5	2.4				**1.2**				
	Cattle (2)	0.0	**0.0**	[0.0 - 84.2]							100.0										
	Swine (1)	0.0	**0.0**	[0.0 - 97.5]							100.0										

[1] There were no *Salmonella* Enteritidis isolates from ground turkey, ground beef, pork chops, and turkeys

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 22b. Distribution of MICs and Occurrence of Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Humans (271)	1.5	**0.0**	[0.0 - 1.4]							91.9	4.4	0.7	1.5	1.5						
	Chicken Breasts (3)	0.0	**33.3**	[0.8 - 90.6]							66.7						**33.3**				
	Chickens (84)	0.0	**1.2**	[0.0 - 6.5]							97.6	1.2				**1.2**					
	Cattle (2)	0.0	**0.0**	[0.0 - 84.2]							100.0										
	Swine (1)	0.0	**0.0**	[0.0 - 97.5]							100.0										
Cephalosporins																					
Ceftiofur	Humans (271)	0.4	**0.0**	[0.0 - 1.4]				1.1	0.7	66.1	31.7		0.4								
	Chicken Breasts (3)	0.0	**33.3**	[0.8 - 90.6]							66.7				**33.3**						
	Chickens (84)	1.2	**1.2**	[0.0 - 6.5]						82.1	15.5		1.2		**1.2**						
	Cattle (2)	0.0	**0.0**	[0.0 - 84.2]						50.0	50.0										
	Swine (1)	0.0	**0.0**	[0.0 - 97.5]							100.0										
Ceftriaxone	Humans (271)	0.0	**0.0**	[0.0 - 1.4]					99.6	0.4											
	Chicken Breasts (3)	0.0	**0.0**	[0.0 - 70.8]					66.7					33.3							
	Chickens (84)	0.0	**0.0**	[0.0 - 4.3]					97.6			1.2	1.2								
	Cattle (2)	0.0	**0.0**	[0.0 - 84.2]					100.0												
	Swine (1)	0.0	**0.0**	[0.0 - 97.5]					100.0												
Cephamycins																					
Cefoxitin	Humans (271)	0.0	**0.0**	[0.0 - 1.4]						0.4	23.2	69.4	5.9	1.1							
	Chicken Breasts (3)	0.0	**33.3**	[0.8 - 90.6]								33.3	33.3			**33.3**					
	Chickens (84)	0.0	**1.2**	[0.0 - 6.5]							8.3	85.7	3.6	1.2		**1.2**					
	Cattle (2)	0.0	**0.0**	[0.0 - 84.2]								100.0									
	Swine (1)	0.0	**0.0**	[0.0 - 97.5]								100.0									
Folate Pathway Inhibitors																					
Sulfisoxazole	Humans (271)	N/A	**1.8**	[0.6 - 4.3]											15.9	77.1	4.8	0.4			**1.8**
	Chicken Breasts (3)	N/A	**33.3**	[0.8 - 90.6]											33.3			33.3			**33.3**
	Chickens (84)	N/A	**1.2**	[0.0 - 6.5]											26.2	66.7	6.0				**1.2**
	Cattle (2)	N/A	**0.0**	[0.0 - 84.2]											100.0						
	Swine (1)	N/A	**0.0**	[0.0 - 97.5]													100.0				

[1] There were no *Salmonella* Enteritidis isolates from ground turkey, ground beef, pork chops, and turkeys

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 22c. Distribution of MICs and Occurrence of Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Trimethoprim-Sulfamethoxazole	Humans (271)	N/A	**0.0**	[0.0 - 1.4]				81.2	18.1	0.7											
	Chicken Breasts (3)	N/A	**0.0**	[0.0 - 70.8]				100.0													
	Chickens (84)	N/A	**0.0**	[0.0 - 4.3]				90.5	9.5												
	Cattle (2)	N/A	**0.0**	[0.0 - 84.2]				100.0													
	Swine (1)	N/A	**0.0**	[0.0 - 97.5]				100.0													
Phenicols																					
Chloramphenicol	Humans (271)	0.4	**0.4**	[0.0 - 2.0]								1.8	51.3	46.1	0.4		**0.4**				
	Chicken Breasts (3)	0.0	**0.0**	[0.0 - 70.8]										100.0							
	Chickens (84)	0.0	**0.0**	[0.0 - 4.3]									29.8	70.2							
	Cattle (2)	0.0	**0.0**	[0.0 - 84.2]									50.0	50.0							
	Swine (1)	0.0	**0.0**	[0.0 - 97.5]										100.0							
Quinolones																					
Ciprofloxacin	Humans (271)	0.4	**0.0**	[0.0 - 1.4]	93.0	0.4		3.3	3.0			0.4									
	Chicken Breasts (3)	0.0	**0.0**	[0.0 - 70.8]	33.3	66.7															
	Chickens (84)	0.0	**0.0**	[0.0 - 4.3]	92.9	7.1															
	Cattle (2)	0.0	**0.0**	[0.0 - 84.2]	100.0																
	Swine (1)	0.0	**0.0**	[0.0 - 97.5]	100.0																
Nalidixic Acid	Humans (271)	N/A	**6.6**	[4.0 - 10.3]						0.4	0.4	11.1	80.4	1.1		**0.4**	**6.3**				
	Chicken Breasts (3)	N/A	**0.0**	[0.0 - 70.8]										100.0							
	Chickens (84)	N/A	**0.0**	[0.0 - 4.3]									92.9	7.1							
	Cattle (2)	N/A	**0.0**	[0.0 - 84.2]								50.0	50.0								
	Swine (1)	N/A	**0.0**	[0.0 - 97.5]										100.0							
Tetracyclines																					
Tetracycline	Humans (271)	1.1	**3.3**	[1.5 - 6.2]									95.6	1.1	**0.4**		**3.0**				
	Chicken Breasts (3)	0.0	**33.3**	[0.8 - 90.6]									66.7				**33.3**				
	Chickens (84)	1.2	**2.4**	[0.3 - 8.3]									96.4	1.2			**2.4**				
	Cattle (2)	0.0	**0.0**	[0.0 - 84.2]									100.0								
	Swine (1)	0.0	**0.0**	[0.0 - 97.5]									100.0								

[1] There were no *Salmonella* Enteritidis isolates from ground turkey, ground beef, pork chops, and turkeys

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Resistance by Year

Table 23a. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	351	301	244	269	319	277	337	257	271
		Chicken Breasts							4	3	3
		Ground Turkey							5	1	0
		Ground Beef							1	1	0
		Pork Chops							0	0	0
		Chickens		1	13	41	31	21	48	42	84
		Turkeys		0	0	1	1	0	0	0	0
		Cattle		1	1	8	4	4	6	3	2
		Swine		0	0	2	1	1	1	1	1
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Aminoglycosides	Amikacin (MIC ≥ 64 µg/ml)	Humans		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Gentamicin (MIC ≥ 16 µg/ml)	Humans	4.8% 17	0.3% 1	0.4% 1	0.0% 0	0.3% 1	0.0% 0	0.3% 1	0.4% 1	0.4% 1
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.2% 1
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Kanamycin (MIC ≥ 64 µg/ml)	Humans	0.0% 0	0.7% 2	0.4% 1	0.4% 1	0.3% 1	0.7% 2	0.3% 1	0.0% 0	0.7% 2
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.1% 1	0.0% 0	0.0% 0
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	12.5% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	100.0% 1	0.0% 0	0.0% 0	0.0% 0
	Streptomycin (MIC ≥ 64 µg/ml)	Humans	2.0% 7	4.3% 13	1.6% 4	2.2% 6	0.0% 0	1.4% 4	1.8% 6	1.2% 3	2.2% 6
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.1% 1	0.0% 0	1.2% 1
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	12.5% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	100.0% 1	0.0% 0	0.0% 0	0.0% 0

Table 23b. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	351	301	244	269	319	277	337	257	271
		Chicken Breasts							4	3	3
		Ground Turkey							5	1	0
		Ground Beef							1	1	0
		Pork Chops							0	0	0
		Chickens		1	13	41	31	21	48	42	84
		Turkeys		0	0	1	1	0	0	0	0
		Cattle		1	1	8	4	4	6	3	2
		Swine		0	0	2	1	1	1	1	1
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Aminopenicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	20.5% 72	11.3% 34	6.1% 15	10.8% 29	7.5% 24	8.7% 24	7.1% 24	2.3% 6	4.1% 11
		Chicken Breasts							0.0% 0	66.7% 2	33.3% 1
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		100.0% 1	30.8% 4	12.2% 5	9.7% 3	0.0% 0	4.2% 2	0.0% 0	1.2% 1
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	100.0% 1	12.5% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	100.0% 1	0.0% 0	0.0% 0	0.0% 0
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	0.6% 2	0.0% 0	0.0% 0	0.4% 1	0.0% 0	1.4% 4	0.6% 2	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	33.3% 1	33.3% 1
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	2.4% 1	3.2% 1	0.0% 0	4.2% 2	0.0% 0	1.2% 1
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Cephalosporins	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	0.0% 0	0.3% 1	0.0% 0	0.4% 1	0.0% 0	2.2% 6	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	33.3% 1	33.3% 1
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	4.9% 2	3.2% 1	0.0% 0	4.2% 2	0.0% 0	1.2% 1
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ceftriaxone (MIC ≥ 64 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.1% 1	0.0% 0	0.0% 0
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0

Table 23c. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	351	301	244	269	319	277	337	257	271
		Chicken Breasts							4	3	3
		Ground Turkey							5	1	0
		Ground Beef							1	1	0
		Pork Chops							0	0	0
		Chickens		1	13	41	31	21	48	42	84
		Turkeys		0	0	1	1	0	0	0	0
		Cattle		1	1	8	4	4	6	3	2
		Swine		0	0	2	1	1	1	1	1
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Cephalosporins	Cephalothin (MIC ≥ 32 µg/ml)	Humans	4.0% 14	1.3% 4	0.0% 0	1.9% 5	0.9% 3	1.1% 3	0.6% 2	1.2% 3	
		Chicken Breasts							0.0% 0	66.7% 2	
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0%	7.7% 1	4.9% 2	0.0% 0	0.0% 0	4.2% 2	0.0% 0	
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
		Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
Cephamycins	Cefoxitin (MIC ≥ 32 µg/ml)	Humans					0.0% 0	0.4% 1	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	33.3% 1	33.3% 1
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens					0.0% 0	0.0% 0	2.1% 1	0.0% 0	1.2% 1
		Turkeys					0.0% 0				
		Cattle					0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine					0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole[1] (MIC ≥ 512 µg/ml)	Humans	8.5% 30	9.0% 27	2.0% 5	3.0% 8	0.9% 3	2.2% 6	1.8% 6	1.2% 3	1.8% 5
		Chicken Breasts							0.0% 0	0.0% 0	33.3% 1
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	4.9% 2	3.2% 1	0.0% 0	4.2% 2	2.4% 1	1.2% 1
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Trimethoprim-Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	6.6% 23	1.3% 4	0.8% 2	0.7% 2	0.0% 0	0.7% 2	0.6% 2	0.8% 2	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0

[1] Sulfamethoxazole was tested from 1996 to 2003 and was replaced by sulfisoxazole in 2004

Table 23d. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	351	301	244	269	319	277	337	257	271
		Chicken Breasts							4	3	3
		Ground Turkey							5	1	0
		Ground Beef							1	1	0
		Pork Chops							0	0	0
		Chickens		1	13	41	31	21	48	42	84
		Turkeys		0	0	1	1	0	0	0	0
		Cattle		1	1	8	4	4	6	3	2
		Swine		0	0	2	1	1	1	1	1
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Phenicols	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	0.0% 0	0.7% 2	0.0% 0	0.4% 1	0.0% 0	0.0% 0	0.6% 2	0.4% 1	0.4% 1
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	0.9% 3	1.7% 5	2.0% 5	2.2% 6	2.2% 7	4.3% 12	3.9% 13	4.7% 12	6.6% 18
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	16.8% 59	9.6% 29	6.6% 16	8.2% 22	1.9% 6	1.8% 5	4.5% 15	1.6% 4	3.3% 9
		Chicken Breasts							0.0% 0	0.0% 0	33.3% 1
		Ground Turkey							0.0% 0	0.0% 0	
		Ground Beef							0.0% 0	0.0% 0	
		Pork Chops									
		Chickens		0.0% 0	0.0% 0	7.3% 3	0.0% 0	0.0% 0	2.1% 1	2.4% 1	2.4% 2
		Turkeys				0.0% 0	0.0% 0				
		Cattle		0.0% 0	100.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine				0.0% 0	0.0% 0	100.0% 1	0.0% 0	0.0% 0	0.0% 0

Multidrug Resistance

Table 24a. Resistance Patterns among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year		1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested	Humans	351	301	244	269	319	277	337	257	271
	Chicken Breasts							4	3	3
	Ground Turkey							5	1	0
	Ground Beef							1	1	0
	Pork Chops							0	0	0
	Chickens		1	13	41	31	21	48	42	84
	Turkeys		0	0	1	1	0	0	0	0
	Cattle		1	1	8	4	4	6	3	2
	Swine		0	0	2	1	1	1	1	1
Resistance Pattern	**Isolate Source**									
1. No Resistance Detected	Humans	73.5% 258	77.4% 233	87.7% 214	83.6% 225	89.0% 284	86.6% 240	87.2% 294	91.8% 236	87.1% 236
	Chicken Breasts							100.0% 4	33.3% 1	66.7% 2
	Ground Turkey							100.0% 5	100.0% 1	
	Ground Beef							100.0% 1	100.0% 1	
	Pork Chops									
	Chickens		0.0% 0	69.2% 9	82.9% 34	90.3% 28	100.0% 21	95.8% 46	97.6% 41	97.6% 82
	Turkeys				100.0% 1	100.0% 1				
	Cattle		100.0% 1	0.0% 0	87.5% 7	100.0% 4	100.0% 4	100.0% 6	100.0% 3	100.0% 2
	Swine		0.0% 0	0.0% 0	100.0% 2	100.0% 1	0.0% 0	100.0% 1	100.0% 1	100.0% 1
2. At Least ACSSuT[1] Resistant	Humans	0.0% 0	0.3% 1	0.0% 0	0.4% 1	0.0% 0	0.0% 0	0.3% 1	0.4% 1	0.4% 1
	Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
	Ground Turkey							0.0% 0	0.0% 0	
	Ground Beef							0.0% 0	0.0% 0	
	Pork Chops									
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Turkeys				0.0% 0	0.0% 0				
	Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
3. At Least ACT/S[2] Resistant	Humans	0.0% 0	0.3% 1	0.0% 0	0.4% 1	0.0% 0	0.0% 0	0.0% 0	0.4% 1	0.0% 0
	Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
	Ground Turkey							0.0% 0	0.0% 0	
	Ground Beef							0.0% 0	0.0% 0	
	Pork Chops									
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Turkeys				0.0% 0	0.0% 0				
	Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0

[1] ACSSuT = ampicillin, chloramphenicol, streptomycin, sulfamethoxazole/sulfisoxazole, and tetracycline

[2] ACT/S = ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole

Table 24b. Resistance Patterns among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year		1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested	Humans	351	301	244	269	319	277	337	257	271
	Chicken Breasts							4	3	3
	Ground Turkey							5	1	0
	Ground Beef							1	1	0
	Pork Chops							0	0	0
	Chickens		1	13	41	31	21	48	42	84
	Turkeys		0	0	1	1	0	0	0	0
	Cattle		1	1	8	4	4	6	3	2
	Swine		0	0	2	1	1	1	1	1
Resistance Pattern	**Isolate Source**									
4. At Least ACSSuTAuCf[1] Resistant	Humans	0.0% 0	0.0% 0	0.0% 0	0.4% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
	Ground Turkey							0.0% 0	0.0% 0	
	Ground Beef							0.0% 0	0.0% 0	
	Pork Chops									
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Turkeys				0.0% 0	0.0% 0				
	Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
5. At Least Ceftiofur and Nalidixic Acid Resistant	Humans	0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
	Ground Turkey							0.0% 0	0.0% 0	
	Ground Beef							0.0% 0	0.0% 0	
	Pork Chops									
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Turkeys				0.0% 0	0.0% 0				
	Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0

[1] ACSSuTAuCf = ACSSuT, amoxicillin-clavulanic acid, and ceftiofur

G. Antimicrobial Susceptibility among *Salmonella* Newport

MIC Distributions

Table 25a. Distribution of MICs and Occurrence of Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Aminoglycosides																					
Amikacin	Humans (191)	0.0	0.0	[0.0 - 1.9]						6.8	71.7	17.8	3.1	0.5							
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]								100.0									
	Ground Beef (2)	0.0	**0.0**	[0.0 - 84.2]							100.0										
	Turkeys (7)	0.0	**0.0**	[0.0 - 43.9]							71.4	28.6									
	Cattle (44)	0.0	**0.0**	[0.0 - 10.0]						31.8	56.8	11.4									
Gentamicin	Humans (191)	0.0	**0.5**	[0.0 - 2.9]					78.5	19.4	1.6					**0.5**					
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]						100.0											
	Ground Beef (2)	0.0	**0.0**	[0.0 - 84.2]					100.0												
	Turkeys (7)	0.0	**14.3**	[0.8 - 58.0]					57.1	28.6						**14.3**					
	Cattle (44)	2.3	**0.0**	[0.0 - 10.0]					72.7	25.0				2.3							
Kanamycin	Humans (191)	0.0	**2.6**	[0.9 - 6.0]										97.4				**2.6**			
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]										100.0							
	Ground Beef (2)	0.0	**0.0**	[0.0 - 84.2]										100.0							
	Turkeys (7)	0.0	**14.3**	[0.8 - 58.0]										85.7				**14.3**			
	Cattle (44)	0.0	**25.0**	[13.7 - 40.6]										75.0				**25.0**			
Streptomycin	Humans (191)	N/A	**15.7**	[10.9 - 21.7]												84.3		**15.7**			
	Ground Turkey (2)	N/A	**0.0**	[0.0 - 84.2]												100.0					
	Ground Beef (2)	N/A	**100.0**	[15.8 - 100.0]														**100.0**			
	Turkeys (7)	N/A	**14.3**	[0.8 - 58.0]												85.7		**14.3**			
	Cattle (44)	N/A	**84.1**	[69.3 - 92.8]												15.9	**2.3**	**81.8**			
Aminopenicillins																					
Ampicillin	Humans (191)	0.0	**15.7**	[10.9 - 21.7]							57.6	25.7	1.0				**15.7**				
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]								100.0									
	Ground Beef (2)	0.0	**100.0**	[15.8 - 100.0]													**100.0**				
	Turkeys (7)	0.0	**28.6**	[5.1 - 69.8]							42.9	28.6					**28.6**				
	Cattle (44)	0.0	**81.8**	[66.7 - 91.3]							18.2						**81.8**				

[1] There were no *Salmonella* Newport isolates from chicken breasts, pork chops, chickens, and swine

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 25b. Distribution of MICs and Occurrence of Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Humans (191)	0.0	**15.2**	[10.4 - 21.1]							81.1	2.1	0.5	1.0		**3.7**	**11.5**				
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]								100.0									
	Ground Beef (2)	0.0	**100.0**	[15.8 - 100.0]													**100.0**				
	Turkeys (7)	0.0	**14.3**	[0.8 - 58.0]							71.4			14.3			**14.3**				
	Cattle (44)	2.3	**77.3**	[61.8 - 88.0]							18.2			2.3	2.3	**2.3**	**75.0**				
Cephalosporins																					
Ceftiofur	Humans (191)	0.0	**15.2**	[10.5 - 21.1]				0.5	0.5	73.8	9.9			**0.5**	**14.7**						
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]							100.0										
	Ground Beef (2)	0.0	**100.0**	[15.8 - 100.0]											**100.0**						
	Turkeys (7)	0.0	**14.3**	[0.8 - 58.0]						85.7					**14.3**						
	Cattle (44)	0.0	**77.3**	[61.8 - 88.0]						20.5	2.3				**77.3**						
Ceftriaxone	Humans (191)	12.1	**2.6**	[0.9 - 6.0]					84.3	1.0					4.7	7.3	**2.1**	**0.5**			
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]					100.0												
	Ground Beef (2)	50.0	**50.0**	[1.3 - 98.7]												50.0	**50.0**				
	Turkeys (7)	14.3	**0.0**	[0.0 - 84.2]					85.7							14.3					
	Cattle (44)	63.6	**11.4**	[4.3 - 25.4]					22.7					2.3	27.3	36.4	**9.1**	**2.3**			
Cephamycins																					
Cefoxitin	Humans (191)	0.0	**15.2**	[10.4 - 21.1]							23.6	56.0	3.7	1.6		**3.1**	**12.0**				
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]								100.0									
	Ground Beef (2)	0.0	**100.0**	[15.8 - 100.0]													**100.0**				
	Turkeys (7)	0.0	**14.3**	[0.8 - 58.0]							14.3	71.4					**14.3**				
	Cattle (44)	0.0	**77.3**	[61.8 - 88.0]							9.1	13.6				**22.7**	**54.5**				
Folate Pathway Inhibitors																					
Sulfisoxazole	Humans (191)	N/A	**16.8**	[11.8 - 22.8]											5.8	41.9	35.1	0.5			**16.8**
	Ground Turkey (2)	N/A	**0.0**	[0.0 - 84.2]													100.0				
	Ground Beef (2)	N/A	**100.0**	[15.8 - 100.0]																	**100.0**
	Turkeys (7)	N/A	**14.3**	[0.8 - 58.0]											28.6	57.1					**14.3**
	Cattle (44)	N/A	**84.1**	[69.3 - 92.8]											4.5	9.1	2.3				**84.1**

[1] There were no *Salmonella* Newport isolates from chicken breasts, pork chops, chickens, and swine

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 25c. Distribution of MICs and Occurrence of Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Trimethoprim-Sulfamethoxazole	Humans (191)	N/A	**2.1**	[0.6 - 5.3]				73.3	23.0	0.5	0.5	0.5		**2.1**							
	Ground Turkey (2)	N/A	**0.0**	[0.0 - 84.2]				100.0													
	Ground Beef (2)	N/A	**50.0**	[1.3 - 98.7]				50.0						**50.0**							
	Turkeys (7)	N/A	**14.3**	[0.8 - 58.0]				28.6	42.9			14.3		**14.3**							
	Cattle (44)	N/A	**2.3**	[0.1 - 13.5]				40.9	50.0	6.8				**2.3**							
Phenicols																					
Chloramphenicol	Humans (191)	0.0	**15.2**	[10.5 - 21.1]								2.1	54.5	28.3			**15.2**				
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]										100.0							
	Ground Beef (2)	0.0	**100.0**	[15.8 - 100.0]													**100.0**				
	Turkeys (7)	0.0	**14.3**	[0.8 - 58.0]									57.1	28.6			**14.3**				
	Cattle (44)	0.0	**77.3**	[61.8 - 88.0]									20.5	2.3			**77.3**				
Quinolones																					
Ciprofloxacin	Humans (191)	0.0	**0.0**	[0.0 - 1.9]	98.4	1.0		0.5													
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]	100.0																
	Ground Beef (2)	0.0	**0.0**	[0.0 - 84.2]	100.0																
	Turkeys (7)	0.0	**0.0**	[0.0 - 43.9]	100.0																
	Cattle (44)	0.0	**0.0**	[0.0 - 10.0]	97.7	2.3															
Nalidixic Acid	Humans (191)	N/A	**0.5**	[0.0 - 2.9]							1.0	34.6	62.3	1.6			**0.5**				
	Ground Turkey (2)	N/A	**0.0**	[0.0 - 84.2]									100.0								
	Ground Beef (2)	N/A	**0.0**	[0.0 - 84.2]								50.0	50.0								
	Turkeys (7)	N/A	**0.0**	[0.0 - 43.9]								14.3	85.7								
	Cattle (44)	N/A	**0.0**	[0.0 - 10.0]								15.9	84.1								
Tetracyclines																					
Tetracycline	Humans (191)	0.0	**16.8**	[11.8 - 22.8]									83.2			**4.2**	**12.6**				
	Ground Turkey (2)	0.0	**0.0**	[0.0 - 84.2]									100.0								
	Ground Beef (2)	0.0	**100.0**	[15.8 - 100.0]													**100.0**				
	Turkeys (7)	0.0	**28.6**	[5.1 - 69.8]									71.4				**28.6**				
	Cattle (44)	0.0	**84.1**	[69.3 - 92.8]									15.9			**9.1**	**75.0**				

[1] There were no *Salmonella* Newport isolates from chicken breasts, pork chops, chickens, and swine

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Resistance by Year

Table 26a. Antimicrobial Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	51	46	77	99	121	124	239	223	191
		Chicken Breasts							0	0	0
		Ground Turkey							3	2	2
		Ground Beef							3	1	2
		Pork Chops							2	1	0
		Chickens		0	1	7	5	8	6	7	0
		Turkeys		0	1	4	6	16	10	19	7
		Cattle		0	8	54	109	87	113	75	44
		Swine		0	1	5	2	7	0	3	0
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Aminoglycosides	Amikacin (MIC ≥ 64)	Humans		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts									
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	0.0% 0
		Pork Chops							0.0% 0	0.0% 0	
		Chickens			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine			0.0% 0	0.0% 0	0.0% 0	0.0% 0		0.0% 0	
	Gentamicin (MIC ≥ 16)	Humans	5.9% 3	4.3% 2	0.0% 0	0.0% 0	2.5% 3	3.2% 4	3.3% 8	3.1% 7	0.5% 1
		Chicken Breasts									
		Ground Turkey							0.0% 0	50.0% 1	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	0.0% 0
		Pork Chops							0.0% 0	0.0% 0	
		Chickens			100.0% 1	0.0% 0	20.0% 1	0.0% 0	0.0% 0	0.0% 0	
		Turkeys			0.0% 0	0.0% 0	16.7% 1	6.3% 1	0.0% 0	52.6% 10	14.3% 1
		Cattle			0.0% 0	1.9% 1	11.0% 12	6.9% 6	7.1% 8	1.3% 1	0.0% 0
		Swine			0.0% 0	0.0% 0	0.0% 0	0.0% 0		0.0% 0	
	Kanamycin (MIC ≥ 64)	Humans	2.0% 1	0.0% 0	1.3% 1	1.0% 1	5.0% 6	7.3% 9	9.6% 23	4.5% 10	2.6% 5
		Chicken Breasts									
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	0.0% 0
		Pork Chops							0.0% 0	0.0% 0	
		Chickens			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	0.0% 0	10.0% 1	21.1% 4	14.3% 1
		Cattle			0.0% 0	0.0% 0	9.2% 10	6.9% 6	15.9% 18	17.3% 13	25.0% 11
		Swine			0.0% 0	0.0% 0	0.0% 0	57.1% 4		0.0% 0	
	Streptomycin (MIC ≥ 64)	Humans	7.8% 4	4.3% 2	2.6% 2	19.2% 19	24.0% 29	31.5% 39	24.7% 59	24.2% 54	15.7% 30
		Chicken Breasts									
		Ground Turkey							33.3% 1	50.0% 1	0.0% 0
		Ground Beef							66.7% 2	100.0% 1	100.0% 2
		Pork Chops							100.0% 2	100.0% 1	
		Chickens			100.0% 1	0.0% 0	20.0% 1	37.5% 3	0.0% 0	85.7% 6	
		Turkeys			0.0% 0	0.0% 0	16.7% 1	12.5% 2	0.0% 0	31.6% 6	14.3% 1
		Cattle			12.5% 1	37.0% 20	79.8% 87	73.6% 64	80.5% 91	84.0% 63	84.1% 37
		Swine			0.0% 0	0.0% 0	50.0% 1	85.7% 6		100.0% 3	

Table 26b. Antimicrobial Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	51	46	77	99	121	124	239	223	191
		Chicken Breasts							0	0	0
		Ground Turkey							3	2	2
		Ground Beef							3	1	2
		Pork Chops							2	1	0
		Chickens		0	1	7	5	8	6	7	0
		Turkeys		0	1	4	6	16	10	19	7
		Cattle		0	8	54	109	87	113	75	44
		Swine		0	1	5	2	7	0	3	0
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Aminopenicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	5.9% 3	6.5% 3	2.6% 2	18.2% 18	23.1% 28	29.8% 37	24.3% 58	22.9% 51	15.7% 30
		Chicken Breasts									
		Ground Turkey							33.3% 1	0.0% 0	0.0% 0
		Ground Beef							66.7% 2	100.0% 1	100.0% 2
		Pork Chops							100.0% 2	100.0% 1	
		Chickens			100.0% 1	0.0% 0	0.0% 0	37.5% 3	16.7% 1	85.7% 6	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	15.8% 3	28.6% 2
		Cattle			12.5% 1	37.0% 20	77.1% 84	70.1% 61	78.8% 89	82.7% 62	81.8% 36
		Swine			0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3	
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	2.0% 1	0.0% 0	2.6% 2	18.2% 18	22.3% 27	26.6% 33	22.2% 53	21.5% 48	15.2% 29
		Chicken Breasts									
		Ground Turkey							33.3% 1	0.0% 0	0.0% 0
		Ground Beef							66.7% 2	100.0% 1	100.0% 2
		Pork Chops							100.0% 2	100.0% 1	
		Chickens			0.0% 0	0.0% 0	0.0% 0	37.5% 3	0.0% 0	85.7% 6	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	10.5% 2	14.3% 1
		Cattle			12.5% 1	37.0% 20	76.1% 83	69.0% 60	78.8% 89	81.3% 61	77.3% 34
		Swine			0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3	
Cephalosporins	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	0.0% 0	0.0% 0	1.3% 1	18.2% 18	22.3% 27	27.4% 34	22.2% 53	22.0% 49	15.2% 29
		Chicken Breasts									
		Ground Turkey							33.3% 1	0.0% 0	0.0% 0
		Ground Beef							66.7% 2	100.0% 1	100.0% 2
		Pork Chops							100.0% 2	100.0% 1	
		Chickens			0.0% 0	0.0% 0	0.0% 0	37.5% 3	0.0% 0	85.7% 6	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	10.5% 2	14.3% 1
		Cattle			12.5% 1	37.0% 20	76.1% 83	69.0% 60	78.8% 89	81.3% 61	77.3% 34
		Swine			0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3	
	Ceftriaxone (MIC ≥ 64 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	3.0% 3	0.0% 0	0.0% 0	0.8% 2	1.8% 4	2.6% 5
		Chicken Breasts									
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	50.0% 1
		Pork Chops							0.0% 0	0.0% 0	
		Chickens			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle			0.0% 0	0.0% 0	0.9% 1	1.1% 1	0.9% 1	1.3% 1	11.4% 5
		Swine			0.0% 0	0.0% 0	0.0% 0	0.0% 0		0.0% 0	

Table 26c. Antimicrobial Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	51	46	77	99	121	124	239	223	191
		Chicken Breasts						0	0	0	0
		Ground Turkey						0	3	2	2
		Ground Beef						0	3	1	2
		Pork Chops						0	2	1	0
		Chickens		0	1	7	5	8	6	7	0
		Turkeys		0	1	4	6	16	10	19	7
		Cattle		0	8	54	109	87	113	75	44
		Swine		0	1	5	2	7	0	3	0
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Cephalosporins	Cephalothin (MIC ≥ 32 µg/ml)	Humans	3.9% 2	4.3% 2	2.6% 2	18.2% 18	22.3% 27	26.6% 33	22.2% 53	22.4% 50	
		Chicken Breasts									
		Ground Turkey							33.3% 1	0.0% 0	
		Ground Beef							66.7% 2	100.0% 1	
		Pork Chops							100.0% 2	100.0% 1	
		Chickens			0.0% 0	0.0% 0	0.0% 0	37.5% 3	0.0% 0	85.7% 6	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	10.5% 2	
		Cattle			12.5% 1	37.0% 20	74.3% 81	69.0% 60	78.8% 89	81.3% 61	
		Swine			0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3	
Cephamycins	Cefoxitin (MIC ≥ 32 µg/ml)	Humans					22.3% 27	25.8% 32	22.2% 53	21.5% 48	15.2% 29
		Chicken Breasts									
		Ground Turkey							33.3% 1	0.0% 0	0.0% 0
		Ground Beef							66.7% 2	100.0% 1	100.0% 2
		Pork Chops							100.0% 2	100.0% 1	
		Chickens					0.0% 0	37.5% 3	0.0% 0	71.4% 5	
		Turkeys					0.0% 0	12.5% 2	0.0% 0	10.5% 2	14.3% 1
		Cattle					73.4% 80	66.7% 58	77.9% 88	74.7% 56	77.3% 34
		Swine					0.0% 0	85.7% 6		100.0% 3	
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole[1] (MIC ≥ 512 µg/ml)	Humans	11.8% 6	4.3% 2	3.9% 3	22.2% 22	23.1% 28	32.3% 40	25.1% 60	24.7% 55	16.8% 32
		Chicken Breasts									
		Ground Turkey							33.3% 1	50.0% 1	0.0% 0
		Ground Beef							66.7% 2	100.0% 1	100.0% 2
		Pork Chops							100.0% 2	100.0% 1	
		Chickens			100.0% 1	0.0% 0	0.0% 0	37.5% 3	0.0% 0	71.4% 5	
		Turkeys			0.0% 0	0.0% 0	16.7% 1	12.5% 2	0.0% 0	52.6% 10	14.3% 1
		Cattle			12.5% 1	35.2% 19	73.4% 80	72.4% 63	74.3% 84	73.3% 55	84.1% 37
		Swine			0.0% 0	0.0% 0	50.0% 1	85.7% 6		100.0% 3	
	Trimethoprim-Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	3.9% 2	4.3% 2	1.3% 1	2.0% 2	4.1% 5	1.6% 2	4.2% 10	0.9% 2	2.1% 4
		Chicken Breasts									
		Ground Turkey							33.3% 1	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	50.0% 1
		Pork Chops							100.0% 0	0.0% 0	
		Chickens			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	14.3% 1
		Cattle			0.0% 0	1.9% 1	14.7% 16	12.6% 11	7.1% 8	0.0% 0	2.3% 1
		Swine			0.0% 0	0.0% 0	0.0% 0	0.0% 0		33.3% 1	

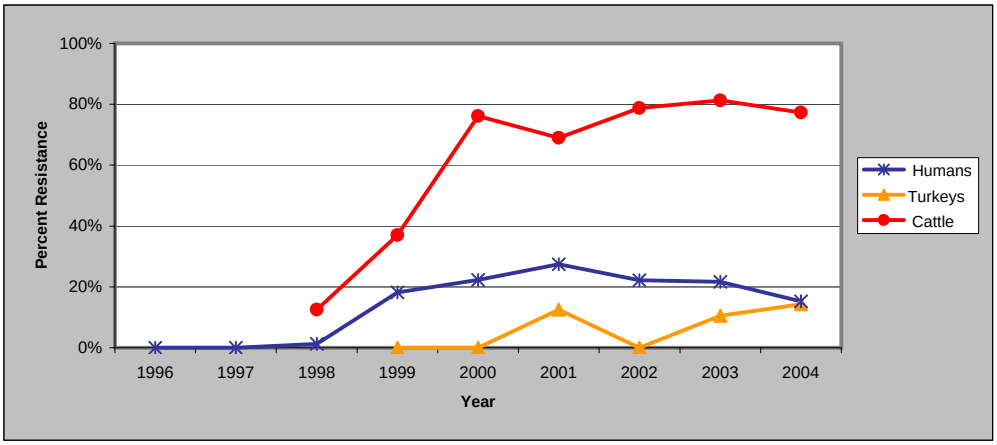
[1] Sulfamethoxazole was tested from 1996 to 2003 and was replaced by sulfisoxazole in 2004

Table 26d. Antimicrobial Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	51	46	77	99	121	124	239	223	191
		Chicken Breasts							0	0	0
		Ground Turkey							3	2	2
		Ground Beef							3	1	2
		Pork Chops							2	1	0
		Chickens		0	1	7	5	8	6	7	0
		Turkeys		0	1	4	6	16	10	19	7
		Cattle		0	8	54	109	87	113	75	44
		Swine		0	1	5	2	7	0	3	0
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Phenicols	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	5.9% 3	4.3% 2	2.6% 2	18.2% 18	23.1% 28	28.2% 35	24.7% 59	22.4% 50	15.2% 29
		Chicken Breasts									
		Ground Turkey							33.3% 1	0.0% 0	0.0% 0
		Ground Beef							66.7% 2	100.0% 1	100.0% 2
		Pork Chops							100.0% 2	100.0% 1	
		Chickens			0.0% 0	0.0% 0	0.0% 0	37.5% 3	0.0% 0	85.7% 6	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	21.1% 4	14.3% 1
		Cattle			12.5% 1	37.0% 20	78.9% 86	73.6% 64	77.9% 88	78.7% 59	77.3% 34
		Swine			0.0% 0	0.0% 0	50.0% 1	85.7% 6		100.0% 3	
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts									
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	0.0% 0
		Pork Chops							0.0% 0	0.0% 0	
		Chickens			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine			0.0% 0	0.0% 0	0.0% 0	0.0% 0		0.0% 0	
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.8% 1	0.0% 0	0.8% 2	0.4% 1	0.5% 1
		Chicken Breasts									
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	0.0% 0	0.0% 0
		Pork Chops							0.0% 0	0.0% 0	
		Chickens			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.3% 1	0.0% 0
		Swine			0.0% 0	0.0% 0	0.0% 0	0.0% 0		0.0% 0	
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	7.8% 4	4.3% 2	2.6% 2	19.2% 19	23.1% 28	30.6% 38	25.1% 60	24.2% 54	16.8% 32
		Chicken Breasts									
		Ground Turkey							33.3% 1	0.0% 0	0.0% 0
		Ground Beef							66.7% 2	100.0% 1	100.0% 2
		Pork Chops							100.0% 2	100.0% 1	
		Chickens			100.0% 1	0.0% 0	0.0% 0	37.5% 3	0.0% 0	85.7% 6	
		Turkeys			0.0% 0	0.0% 0	0.0% 0	12.5% 2	40.0% 4	36.8% 7	28.6% 2
		Cattle			12.5% 1	38.9% 21	80.7% 88	73.6% 64	80.5% 91	84.0% 63	84.1% 37
		Swine			100.0% 1	20.0% 1	50.0% 1	85.7% 6		100.0% 3	

Ceftiofur Resistance

Figure 13. Percent of *Salmonella* Newport Isolates from Humans, Turkeys, and Cattle[1] Resistant to Ceftiofur, by Year, 1996-2004



[1] Data for other sources are not included due to the small number of *Salmonella* Newport isolates. Table 26 contains resistance data for *Salmonella* Newport isolates from each source, by year

Table 27. Number of *Salmonella* Newport Isolates Tested from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Humans	51	46	77	99	121	124	239	223	191
Chicken Breasts							0	0	0
Ground Turkey							3	2	2
Ground Beef							3	1	2
Pork Chops							2	1	0
Chickens			1	7	5	8	6	7	0
Turkeys			1	4	6	16	10	19	7
Cattle			8	54	109	87	113	75	44
Swine			1	5	2	7	0	3	0

Multidrug Resistance

Table 28a. Resistance Patterns among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year		1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested	Humans	51	46	77	99	121	124	239	223	191
	Chicken Breasts							0	0	0
	Ground Turkey							3	2	2
	Ground Beef							3	1	2
	Pork Chops							2	1	0
	Chickens		0	1	7	5	8	6	7	0
	Turkeys		0	1	4	6	16	10	19	7
	Cattle		0	8	54	109	87	113	75	44
	Swine		0	1	5	2	7	0	3	0
Resistance Pattern	**Isolate Source**									
1. No Resistance Detected	Humans	86.3% 44	93.5% 43	94.8% 73	75.8% 75	75.2% 91	65.3% 81	72.8% 174	73.5% 164	82.2% 157
	Chicken Breasts									
	Ground Turkey							66.7% 2	50.0% 1	100.0% 2
	Ground Beef							33.3% 1	0.0% 0	0.0% 0
	Pork Chops							0.0% 0	0.0% 0	
	Chickens		0.0% 0	0.0% 0	100.0% 7	80.0% 4	62.5% 5	83.3% 5	14.3% 1	
	Turkeys		0.0% 0	100.0% 1	100.0% 4	83.3% 5	87.5% 14	60.0% 6	21.1% 4	57.1% 4
	Cattle		0.0% 0	87.5% 7	61.1% 33	19.3% 21	25.3% 22	19.5% 22	14.7% 11	15.9% 7
	Swine		0.0% 0	0.0% 0	80.0% 4	50.0% 1	14.3% 1		0.0% 0	
2. At Least ACSSuT[1] Resistant	Humans	5.9% 3	4.3% 2	1.3% 1	18.2% 18	23.1% 28	25.8% 32	23.0% 55	22.0% 49	14.7% 28
	Chicken Breasts									
	Ground Turkey							33.3% 1	0.0% 0	0.0% 0
	Ground Beef							66.7% 2	100.0% 1	100.0% 2
	Pork Chops							100.0% 2	100.0% 1	
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	37.5% 3	0.0% 0	71.4% 5	
	Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	5.3% 1	14.3% 1
	Cattle		0.0% 0	12.5% 1	35.2% 19	70.6% 77	67.8% 59	70.8% 80	66.7% 50	75.0% 33
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3	
3. At Least ACT/S[2] Resistant	Humans	3.9% 2	4.3% 2	1.3% 1	2.0% 2	4.1% 5	0.8% 1	3.8% 9	0.9% 2	1.0% 2
	Chicken Breasts									
	Ground Turkey							33.3% 1	0.0% 0	0.0% 0
	Ground Beef							0.0% 0	0.0% 0	50.0% 1
	Pork Chops							100.0% 2	0.0% 0	
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
	Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	14.3% 1
	Cattle		0.0% 0	0.0% 0	1.9% 1	13.8% 15	11.5% 10	7.1% 8	0.0% 0	2.3% 1
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0		33.3% 1	

[1] ACSSuT = ampicillin, chloramphenicol, streptomycin, sulfamethoxazole/sulfisoxazole, and tetracycline

[2] ACT/S = ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole

Table 28b. Resistance Patterns among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year		1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested	Humans	51	46	77	99	121	124	239	223	191
	Chicken Breasts							0	0	0
	Ground Turkey							3	2	2
	Ground Beef							3	1	2
	Pork Chops							2	1	0
	Chickens		0	1	7	5	8	6	7	0
	Turkeys		0	1	4	6	16	10	19	7
	Cattle		0	8	54	109	87	113	75	44
	Swine		0	1	5	2	7	0	3	0
Resistance Pattern	**Isolate Source**									
4. At Least ACSSuTAuCf[1] Resistant	Humans	0.0% 0	0.0% 0	1.3% 1	18.2% 18	22.3% 27	25.0% 31	22.2% 53	21.1% 47	14.7% 28
	Chicken Breasts									
	Ground Turkey							33.3% 1	0.0% 0	0.0% 0
	Ground Beef							66.7% 2	100.0% 1	100.0% 2
	Pork Chops							100.0% 2	100.0% 1	
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	37.5% 3	0.0% 0	71.4% 5	
	Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	5.3% 1	14.3% 1
	Cattle		0.0% 0	12.5% 1	35.2% 19	69.7% 76	66.7% 58	70.8% 80	66.7% 50	72.7% 32
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3	
5. At Least Ceftiofur and Nalidixic Acid Resistant	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.4% 1	0.0% 0	0.5% 1
	Chicken Breasts									
	Ground Turkey							0.0% 0	0.0% 0	0.0% 0
	Ground Beef							0.0% 0	0.0% 0	0.0% 0
	Pork Chops							0.0% 0	0.0% 0	
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
	Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.3% 1	0.0% 0
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0		0.0% 0	

[1] ACSSuTAuCf = ACSSuT, amoxicillin-clavulanic acid, and ceftiofur

H. Antimicrobial Susceptibility among *Salmonella* Heidelberg

MIC Distributions

Table 29a. Distribution of MICs and Occurrence of Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Aminoglycosides																					
Amikacin	Humans (93)	0.0	**0.0**	[0.0 - 3.9]						10.8	71.0	15.1	3.2								
	Chicken Breasts (31)	0.0	**0.0**	[0.0 - 11.2]							29.0	58.1	12.9								
	Ground Turkey (37)	0.0	**0.0**	[0.0 - 9.5]							67.6	27.0	5.4								
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]								66.7	33.3								
	Chickens (167)	0.0	**0.0**	[0.0 - 2.2]						16.8	70.1	12.0	1.2								
	Turkeys (46)	0.0	**0.0**	[0.0 - 7.7]						17.4	78.3	4.3									
	Cattle (1)	0.0	**0.0**	[0.0 - 97.5]							100.0										
	Swine (4)	0.0	**0.0**	[0.0 - 60.2]						50.0	50.0										
Gentamicin	Humans (93)	2.2	**4.3**	[1.2 - 10.6]					71.0	20.4	2.2			2.2	**2.2**	**2.2**					
	Chicken Breasts (31)	0.0	**9.7**	[2.0 - 25.8]					32.3	51.6	6.5				**6.5**	**3.2**					
	Ground Turkey (37)	2.7	**35.1**	[20.2 - 52.5]					21.6	40.5				2.7	**2.7**	**32.4**					
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]					33.3	66.7											
	Chickens (167)	0.0	**10.2**	[6.0 - 15.8]					73.1	16.2	0.6				**7.8**	**2.4**					
	Turkeys (46)	8.7	**17.4**	[7.8 - 31.4]					67.4	6.5				8.7	**15.2**	**2.2**					
	Cattle (1)	0.0	**0.0**	[0.0 - 97.5]						100.0											
	Swine (4)	0.0	**0.0**	[0.0 - 60.2]					100.0												
Kanamycin	Humans (93)	0.0	**8.6**	[3.8 - 16.2]										90.3	1.1		**1.1**	**7.5**			
	Chicken Breasts (31)	0.0	**0.0**	[0.0 - 11.2]										93.5	6.5						
	Ground Turkey (37)	2.7	**27.0**	[13.8 - 44.1]										64.9	5.4	2.7		**27.0**			
	Pork Chops (3)	0.0	**33.3**	[0.8 - 90.6]										66.7				**33.3**			
	Chickens (167)	0.0	**6.0**	[2.9 - 10.7]										93.4	0.6		**3.0**	**3.0**			
	Turkeys (46)	6.5	**19.6**	[9.4 - 33.9]										73.9		6.5	**2.2**	**17.4**			
	Cattle (1)	0.0	**100.0**	[2.5 - 100.0]														**100.0**			
	Swine (4)	0.0	**75.0**	[19.4 - 99.4]										25.0				**75.0**			
Streptomycin	Humans (93)	N/A	**15.1**	[8.5 - 24.0]												84.9	**7.5**	**7.5**			
	Chicken Breasts (31)	N/A	**22.6**	[9.6 - 41.1]												77.4	**16.1**	**6.5**			
	Ground Turkey (37)	N/A	**43.2**	[27.1 - 60.5]												56.8	**16.2**	**27.0**			
	Pork Chops (3)	N/A	**33.3**	[0.8 - 90.6]												66.7		**33.3**			
	Chickens (167)	N/A	**18.0**	[12.5 - 24.6]												82.0	**4.8**	**13.2**			
	Turkeys (46)	N/A	**21.7**	[10.9 - 36.4]												78.3	**8.7**	**13.0**			
	Cattle (1)	N/A	**100.0**	[2.5 - 100.0]														**100.0**			
	Swine (4)	N/A	**75.0**	[19.4 - 99.4]												25.0	**50.0**	**25.0**			

[1] There were no *Salmonella* Heidelberg isolates from ground beef

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 29b. Distribution of MICs and Occurrence of Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Aminopenicillins																					
Ampicillin	Humans (93)	0.0	**25.8**	[17.3 - 35.9]							44.1	29.0	1.1				**25.8**				
	Chicken Breasts (31)	0.0	**25.8**	[11.9 - 44.6]							67.7	6.5					**25.8**				
	Ground Turkey (37)	0.0	**13.5**	[4.5 - 28.8]							70.3	16.2					**13.5**				
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]							100.0										
	Chickens (167)	0.0	**16.2**	[10.9 - 22.6]							72.5	11.4					**16.2**				
	Turkeys (46)	0.0	**17.4**	[7.8 - 31.4]							65.2	17.4					**17.4**				
	Cattle (1)	0.0	**100.0**	[2.5 - 100.0]													**100.0**				
	Swine (4)	0.0	**0.0**	[0.0 - 60.2]							100.0										
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Humans (93)	6.5	**10.8**	[5.3 - 18.9]							72.0	3.2	1.1	6.5	6.5	**2.2**	**8.6**				
	Chicken Breasts (31)	3.2	**9.7**	[2.0 - 25.8]							64.5	9.7		12.9	3.2		**9.7**				
	Ground Turkey (37)	5.4	**5.4**	[0.7 - 18.2]							81.1	5.4		2.7	5.4		**5.4**				
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]							66.7	33.3									
	Chickens (167)	4.8	**10.2**	[6.0 - 15.8]							83.2	0.6		1.2	4.8	**1.2**	**9.0**				
	Turkeys (46)	6.5	**6.5**	[1.4 - 17.9]							80.4	2.2		4.3	6.5		**6.5**				
	Cattle (1)	0.0	**100.0**	[2.5 - 100.0]													**100.0**				
	Swine (4)	0.0	**0.0**	[0.0 - 60.2]							75.0	25.0									
Cephalosporins																					
Ceftiofur	Humans (93)	1.1	**9.7**	[4.5 - 17.6]					1.1	84.9	3.2		1.1		**9.7**						
	Chicken Breasts (31)	0.0	**9.7**	[2.0 - 25.8]					3.2	51.6	35.5				**9.7**						
	Ground Turkey (37)	0.0	**5.4**	[0.7 - 18.2]						51.4	43.2				**5.4**						
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]						33.3	66.7										
	Chickens (167)	0.0	**10.2**	[6.0 - 15.8]				0.6		85.0	3.0	1.2			**10.2**						
	Turkeys (46)	0.0	**6.5**	[1.4 - 17.9]						89.1	4.3				**6.5**						
	Cattle (1)	0.0	**100.0**	[2.5 - 100.0]											**100.0**						
	Swine (4)	0.0	**0.0**	[0.0 - 60.2]						75.0	25.0										
Ceftriaxone	Humans (93)	7.5	**0.0**	[0.0 - 3.9]					90.3					2.2	4.3	3.2					
	Chicken Breasts (31)	6.5	**0.0**	[0.0 - 11.2]					90.3					3.2	6.5						
	Ground Turkey (37)	5.4	**0.0**	[0.0 - 9.5]					94.6							5.4					
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]					100.0												
	Chickens (167)	9.0	**0.6**	[0.0 - 3.3]					89.2	0.6				0.6	7.2	1.8	**0.6**				
	Turkeys (46)	6.5	**0.0**	[0.0 - 7.7]					93.5						4.3	2.2					
	Cattle (1)	100.0	**0.0**	[0.0 - 97.5]											100.0						
	Swine (4)	0.0	**0.0**	[0.0 - 60.2]					100.0												

[1] There were no *Salmonella* Heidelberg isolates from ground beef

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 29c. Distribution of MICs and Occurrence of Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5]															
					0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Cephamycins																					
Cefoxitin	Humans (93)	1.1	**8.6**	[3.8 - 16.2]							65.6	18.3	5.4	1.1	1.1	**6.5**	**2.2**				
	Chicken Breasts (31)	0.0	**9.7**	[2.0 - 25.8]							3.2	83.9	3.2			**3.2**	**6.5**				
	Ground Turkey (37)	0.0	**5.4**	[0.7 - 18.2]								83.8	10.8				**5.4**				
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]								66.7	33.3								
	Chickens (167)	0.0	**10.2**	[6.0 - 15.8]							29.9	56.3	3.0	0.6		**7.8**	**2.4**				
	Turkeys (46)	0.0	**6.5**	[1.4 - 17.9]							23.9	65.2	4.3			**4.3**	**2.2**				
	Cattle (1)	0.0	**100.0**	[2.5 - 100.0]													**100.0**				
	Swine (4)	0.0	**0.0**	[0.0 - 60.2]								100.0									
Folate Pathway Inhibitors																					
Sulfisoxazole	Humans (93)	N/A	**7.5**	[3.1 - 14.9]											43.0	46.2	3.2				**7.5**
	Chicken Breasts (31)	N/A	**12.9**	[3.6 - 29.8]											25.8	41.9	19.4				**12.9**
	Ground Turkey (37)	N/A	**37.8**	[22.5 - 55.2]											2.7	24.3	35.1				**37.8**
	Pork Chops (3)	N/A	**0.0**	[0.0 - 70.8]												33.3	66.7				
	Chickens (167)	N/A	**12.6**	[8.0 - 18.6]											73.1	13.8	0.6				**12.6**
	Turkeys (46)	N/A	**26.1**	[14.3 - 41.1]											41.3	30.4	2.2				**26.1**
	Cattle (1)	N/A	**100.0**	[2.5 - 100.0]																	**100.0**
	Swine (4)	N/A	**0.0**	[0.0 - 60.2]											75.0	25.0					
Trimethoprim-Sulfamethoxazole	Humans (93)	N/A	**0.0**	[0.0 - 3.9]				76.3	22.6			1.1									
	Chicken Breasts (31)	N/A	**0.0**	[0.0 - 11.2]				100.0													
	Ground Turkey (37)	N/A	**0.0**	[0.0 - 9.5]				97.3	2.7												
	Pork Chops (3)	N/A	**0.0**	[0.0 - 70.8]				100.0													
	Chickens (167)	N/A	**0.0**	[0.0 - 2.2]				85.6	14.4												
	Turkeys (46)	N/A	**0.0**	[0.0 - 7.7]				71.7	28.3												
	Cattle (1)	N/A	**100.0**	[2.5 - 100.0]										**100.0**							
	Swine (4)	N/A	**0.0**	[0.0 - 60.2]				100.0													
Phenicols																					
Chloramphenicol	Humans (93)	0.0	**1.1**	[0.0 - 5.8]									44.1	54.8			**1.1**				
	Chicken Breasts (31)	3.2	**3.2**	[0.1 - 16.7]									6.5	87.1	3.2		**3.2**				
	Ground Turkey (37)	0.0	**5.4**	[0.7 - 18.2]										94.6			**5.4**				
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]										100.0							
	Chickens (167)	2.4	**4.2**	[1.7 - 8.4]								1.2	28.1	64.1	2.4		**4.2**				
	Turkeys (46)	0.0	**0.0**	[0.0 - 7.7]									34.8	65.2							
	Cattle (1)	0.0	**100.0**	[2.5 - 100.0]													**100.0**				
	Swine (4)	0.0	**0.0**	[0.0 - 60.2]									25.0	75.0							

[1] There were no *Salmonella* Heidelberg isolates from ground beef

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 29d. Distribution of MICs and Occurrence of Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Quinolones																					
Ciprofloxacin	Humans (93)	0.0	**0.0**	[0.0 - 3.9]	100.0																
	Chicken Breasts (31)	0.0	**0.0**	[0.0 - 11.2]	100.0																
	Ground Turkey (37)	0.0	**0.0**	[0.0 - 9.5]	97.3	2.7															
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]	100.0																
	Chickens (167)	0.0	**0.0**	[0.0 - 2.2]	98.2	1.8															
	Turkeys (46)	0.0	**0.0**	[0.0 - 7.7]	95.7	4.3															
	Cattle (1)	0.0	**0.0**	[0.0 - 97.5]		100.0															
	Swine (4)	0.0	**0.0**	[0.0 - 60.2]	100.0																
Nalidixic Acid	Humans (93)	N/A	**0.0**	[0.0 - 3.9]								11.8	88.2								
	Chicken Breasts (31)	N/A	**0.0**	[0.0 - 11.2]								3.2	90.3	6.5							
	Ground Turkey (37)	N/A	**0.0**	[0.0 - 9.5]									91.9	8.1							
	Pork Chops (3)	N/A	**0.0**	[0.0 - 70.8]									100.0								
	Chickens (167)	N/A	**0.0**	[0.0 - 2.2]							1.2	3.6	95.2								
	Turkeys (46)	N/A	**0.0**	[0.0 - 7.7]								2.2	97.8								
	Cattle (1)	N/A	**0.0**	[0.0 - 97.5]										100.0							
	Swine (4)	N/A	**0.0**	[0.0 - 60.2]									100.0								
Tetracyclines																					
Tetracycline	Humans (93)	0.0	**19.4**	[11.9 - 28.9]									80.6			**3.2**	**16.1**				
	Chicken Breasts (31)	3.2	**6.5**	[0.8 - 21.4]									90.3	3.2			**6.5**				
	Ground Turkey (37)	0.0	**70.3**	[53.0 84.1]									29.7				**70.3**				
	Pork Chops (3)	0.0	**100.0**	[29.2 - 100.0]													**100.0**				
	Chickens (167)	1.8	**15.0**	[9.9 - 21.3]									83.2	1.8	**0.6**	**0.6**	**13.8**				
	Turkeys (46)	0.0	**73.9**	[58.9 - 85.7]									26.1			**2.2**	**71.7**				
	Cattle (1)	0.0	**100.0**	[2.5 - 100.0]													**100.0**				
	Swine (4)	0.0	**75.0**	[19.4 - 99.4]									25.0				**75.0**				

[1] There were no *Salmonella* Heidelberg isolates from ground beef

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Resistance by Year

Table 30a. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	74	75	101	89	79	102	105	96	93
		Chicken Breasts							11	16	31
		Ground Turkey							21	32	37
		Ground Beef							0	0	0
		Pork Chops							3	0	3
		Chickens		51	143	297	259	329	403	226	167
		Turkeys		14	39	139	125	142	60	57	46
		Cattle		1	11	28	6	10	8	9	1
		Swine		7	37	33	22	16	11	11	4
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Aminoglycosides	Amikacin (MIC ≥ 64)	Humans		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef									
		Pork Chops							0.0% 0		0.0% 0
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Gentamicin (MIC ≥ 16)	Humans	23.0% 17	17.3% 13	16.8% 17	14.6% 13	8.9% 7	7.8% 8	3.8% 4	5.2% 5	4.3% 4
		Chicken Breasts							45.5% 5	18.8% 3	9.7% 3
		Ground Turkey							28.6% 6	12.5% 4	35.1% 13
		Ground Beef									
		Pork Chops							100.0% 3		0.0% 0
		Chickens		41.2% 21	26.6% 38	18.5% 55	32.0% 83	12.5% 41	8.9% 36	7.5% 17	10.2% 17
		Turkeys		0.0% 0	17.9% 7	16.5% 23	12.0% 15	13.4% 19	18.3% 11	12.3% 7	17.4% 8
		Cattle		0.0% 0	27.3% 3	39.3% 11	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine		0.0% 0	0.0% 0	0.0% 0	9.1% 2	0.0% 0	9.1% 1	0.0% 0	0.0% 0
	Kanamycin (MIC ≥ 64)	Humans	14.9% 11	8.0% 6	12.9% 13	9.0% 8	15.2% 12	19.6% 20	10.5% 11	8.3% 8	8.6% 8
		Chicken Breasts							36.4% 4	0.0% 0	0.0% 0
		Ground Turkey							42.9% 9	34.4% 11	27.0% 10
		Ground Beef									
		Pork Chops							0.0% 0		33.3% 1
		Chickens		0.0% 0	0.7% 1	1.3% 4	12.0% 31	4.3% 14	3.7% 15	5.3% 12	6.0% 10
		Turkeys		7.1% 1	5.1% 2	17.3% 24	43.2% 54	31.0% 44	30.0% 18	21.1% 12	19.6% 9
		Cattle		0.0% 0	63.6% 7	42.9% 12	16.7% 1	10.0% 1	37.5% 3	55.6% 5	100.0% 1
		Swine		85.7% 6	64.9% 24	60.6% 20	77.3% 17	75.0% 12	54.5% 6	100.0% 11	75.0% 3
	Streptomycin (MIC ≥ 64)	Humans	40.5% 30	24.0% 18	30.7% 31	24.7% 22	22.8% 18	25.5% 26	17.1% 18	12.5% 12	15.1% 14
		Chicken Breasts							63.6% 7	12.5% 2	22.6% 7
		Ground Turkey							61.9% 13	37.5% 12	43.2% 16
		Ground Beef									
		Pork Chops							100.0% 3		33.3% 1
		Chickens		35.3% 18	32.9% 47	23.9% 71	36.7% 95	20.4% 67	18.6% 75	17.7% 40	18.0% 30
		Turkeys		14.3% 2	30.8% 12	30.2% 42	52.8% 66	40.1% 57	35.0% 21	28.1% 16	21.7% 10
		Cattle		0.0% 0	72.7% 8	57.1% 16	16.7% 1	20.0% 2	37.5% 3	55.6% 5	100.0% 1
		Swine		57.1% 4	81.1% 30	63.6% 21	86.4% 19	75.0% 12	45.5% 5	100.0% 11	75.0% 3

Table 30b. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	74	75	101	89	79	102	105	96	93
		Chicken Breasts							11	16	31
		Ground Turkey							21	32	37
		Ground Beef							0	0	0
		Pork Chops							3	0	3
		Chickens		51	143	297	259	329	403	226	167
		Turkeys		14	39	139	125	142	60	57	46
		Cattle		1	11	28	6	10	8	9	1
		Swine		7	37	33	22	16	11	11	4
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Aminopenicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	14.9% 11	13.3% 10	16.8% 17	7.9% 7	10.1% 8	9.8% 10	12.4% 13	10.4% 10	25.8% 24
		Chicken Breasts							18.2% 2	18.8% 3	25.8% 8
		Ground Turkey							19.0% 4	9.4% 3	13.5% 5
		Ground Beef									
		Pork Chops							0.0% 0		0.0% 0
		Chickens		21.6% 11	25.2% 36	16.2% 48	24.7% 64	16.7% 55	14.9% 60	19.0% 43	16.2% 27
		Turkeys		7.1% 1	12.8% 5	8.6% 12	4.0% 5	9.2% 13	13.3% 8	3.5% 2	17.4% 8
		Cattle		0.0% 0	27.3% 3	50.0% 14	0.0% 0	0.0% 0	50.0% 4	55.6% 5	100.0% 1
		Swine		0.0% 0	5.4% 2	0.0% 0	9.1% 2	0.0% 0	18.2% 2	9.1% 1	0.0% 0
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	2.7% 2	1.3% 1	1.0% 1	1.1% 1	3.8% 3	2.9% 3	9.5% 10	5.2% 5	10.8% 10
		Chicken Breasts							0.0% 0	6.3% 1	9.7% 3
		Ground Turkey							19.0% 4	9.4% 3	5.4% 2
		Ground Beef									
		Pork Chops							0.0% 0		0.0% 0
		Chickens		2.0% 1	1.4% 2	1.3% 4	13.5% 35	7.0% 23	8.7% 35	9.3% 21	10.2% 17
		Turkeys		0.0% 0	2.6% 1	0.7% 1	2.4% 3	5.6% 8	5.0% 3	0.0% 0	6.5% 3
		Cattle		0.0% 0	27.3% 3	42.9% 12	0.0% 0	0.0% 0	50.0% 4	55.6% 5	100.0% 1
		Swine		0.0% 0	0.0% 0	0.0% 0	4.5% 1	0.0% 0	9.1% 1	9.1% 1	0.0% 0
Cephalosporins	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	1.4% 1	0.0% 0	0.0% 0	0.0% 0	3.8% 3	2.9% 3	7.6% 8	5.2% 5	9.7% 9
		Chicken Breasts							0.0% 0	6.3% 1	9.7% 3
		Ground Turkey							19.0% 4	0.0% 0	5.4% 2
		Ground Beef									
		Pork Chops							0.0% 0		0.0% 0
		Chickens		2.0% 1	1.4% 2	1.7% 5	13.9% 36	5.8% 19	8.9% 36	9.3% 21	10.2% 17
		Turkeys		0.0% 0	2.6% 1	0.7% 1	3.2% 4	5.6% 8	5.0% 3	0.0% 0	6.5% 3
		Cattle		0.0% 0	27.3% 3	42.9% 12	0.0% 0	0.0% 0	37.5% 3	55.6% 5	100.0% 1
		Swine		0.0% 0	0.0% 0	0.0% 0	4.5% 1	0.0% 0	9.1% 1	9.1% 1	0.0% 0
	Ceftriaxone (MIC ≥ 64 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef									
		Pork Chops							0.0% 0		0.0% 0
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.4% 1	0.0% 0	0.2% 1	0.0% 0	0.6% 1
		Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0

Table 30c. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	74	75	101	89	79	102	105	96	93
		Chicken Breasts							11	16	31
		Ground Turkey							21	32	37
		Ground Beef							0	0	0
		Pork Chops							3	0	3
		Chickens		51	143	297	259	329	403	226	167
		Turkeys		14	39	139	125	142	60	57	46
		Cattle		1	11	28	6	10	8	9	1
		Swine		7	37	33	22	16	11	11	4
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Cephalosporins	Cephalothin (MIC ≥ 32 µg/ml)	Humans	6.8% 5	2.7% 2	5.9% 6	3.4% 3	5.1% 4	3.9% 4	10.5% 11	7.3% 7	
		Chicken Breasts							18.2% 2	12.5% 2	
		Ground Turkey							19.0% 4	12.5% 4	
		Ground Beef									
		Pork Chops							0.0% 0		
		Chickens		2.0% 1	9.8% 14	5.7% 17	15.4% 40	8.5% 28	9.9% 40	12.8% 29	
		Turkeys		0.0% 0	5.1% 2	2.2% 3	2.4% 3	7.0% 10	5.0% 3	1.8% 1	
		Cattle		0.0% 0	27.3% 3	42.9% 12	0.0% 0	0.0% 0	50.0% 4	55.6% 5	
		Swine		0.0% 0	0.0% 0	0.0% 0	4.5% 1	0.0% 0	9.1% 1	9.1% 1	
Cephamycins	Cefoxitin (MIC ≥ 32 µg/ml)	Humans					2.5% 2	2.9% 3	8.6% 9	5.2% 5	8.6% 8
		Chicken Breasts							0.0% 0	6.3% 1	9.7% 3
		Ground Turkey							19.0% 4	0.0% 0	5.4% 2
		Ground Beef									
		Pork Chops							0.0% 0		0.0% 0
		Chickens					13.5% 35	5.2% 17	7.4% 30	7.1% 16	10.2% 17
		Turkeys					2.4% 3	4.9% 7	1.7% 1	0.0% 0	6.5% 3
		Cattle					0.0% 0	0.0% 0	37.5% 3	44.4% 4	100.0% 1
		Swine					4.5% 1	0.0% 0	9.1% 1	9.1% 1	0.0% 0
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole[1] (MIC ≥ 512 µg/ml)	Humans	17.6% 13	21.3% 16	21.8% 22	19.1% 17	11.4% 9	8.8% 9	6.7% 7	7.3% 7	7.5% 7
		Chicken Breasts							45.5% 5	12.5% 2	12.9% 4
		Ground Turkey							33.3% 7	15.6% 5	37.8% 14
		Ground Beef									
		Pork Chops							100.0% 3		0.0% 0
		Chickens		45.1% 23	33.6% 48	26.6% 79	33.2% 86	16.4% 54	9.7% 39	11.1% 25	12.6% 21
		Turkeys		50.0% 7	35.9% 14	33.8% 47	15.2% 19	27.5% 39	30.0% 18	19.3% 11	26.1% 12
		Cattle		0.0% 0	36.4% 4	57.1% 16	0.0% 0	10.0% 1	12.5% 1	44.4% 4	100.0% 1
		Swine		0.0% 0	21.6% 8	21.2% 7	13.6% 3	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Trimethoprim-Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	0.0% 0	0.0% 0	2.0% 2	1.1% 1	1.3% 1	2.0% 2	1.0% 1	2.1% 2	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef									
		Pork Chops							0.0% 0		0.0% 0
		Chickens		0.0% 0	0.7% 1	0.7% 2	0.4% 1	0.3% 1	0.7% 3	0.9% 2	0.0% 0
		Turkeys		7.1% 1	5.1% 2	4.3% 6	0.8% 1	3.5% 5	3.3% 2	3.5% 2	0.0% 0
		Cattle		0.0% 0	27.3% 3	42.9% 12	0.0% 0	10.0% 1	0.0% 0	55.6% 5	100.0% 1
		Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	9.1% 1	0.0% 0	0.0% 0

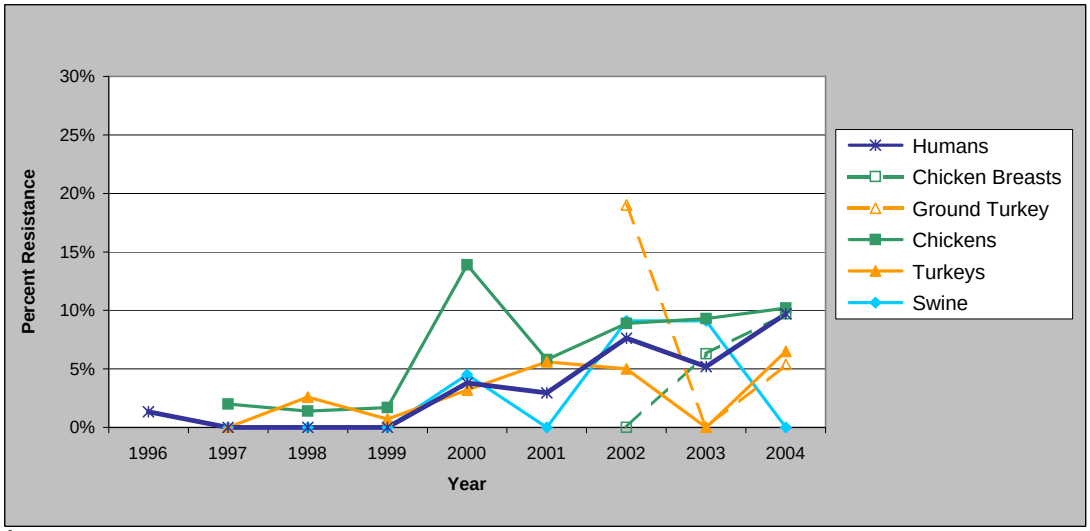
[1] Sulfamethoxazole was tested from 1996 to 2003 and was replaced by sulfisoxazole in 2004

Table 30d. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year			1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	74	75	101	89	79	102	105	96	93
		Chicken Breasts							11	16	31
		Ground Turkey							21	32	37
		Ground Beef							0	0	0
		Pork Chops							3	0	3
		Chickens		51	143	297	259	329	403	226	167
		Turkeys		14	39	139	125	142	60	57	46
		Cattle		1	11	28	6	10	8	9	1
		Swine		7	37	33	22	16	11	11	4
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**									
Phenicols	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	1.4% 1	0.0% 0	1.0% 1	2.2% 2	1.3% 1	1.0% 1	1.0% 1	0.0% 0	1.1% 1
		Chicken Breasts							0.0% 0	0.0% 0	3.2% 1
		Ground Turkey							0.0% 0	0.0% 0	5.4% 2
		Ground Beef									
		Pork Chops							0.0% 0		0.0% 0
		Chickens		0.0% 0	0.7% 1	1.3% 4	11.6% 30	3.3% 11	1.7% 7	3.1% 7	4.2% 7
		Turkeys		0.0% 0	2.6% 1	0.7% 1	1.6% 2	2.8% 4	1.7% 1	0.0% 0	0.0% 0
		Cattle		0.0% 0	27.3% 3	42.9% 12	0.0% 0	10.0% 1	25.0% 2	44.4% 4	100.0% 1
		Swine		0.0% 0	0.0% 0	3.0% 1	4.5% 1	0.0% 0	9.1% 1	0.0% 0	0.0% 0
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0
		Ground Beef									
		Pork Chops							0.0% 0		0.0% 0
		Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	0.0% 0	0.0% 0	1.0% 1	1.1% 1	1.3% 1	0.0% 0	0.0% 0	1.0% 1	0.0% 0
		Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
		Ground Turkey							4.8% 1	0.0% 0	0.0% 0
		Ground Beef									
		Pork Chops							0.0% 0		0.0% 0
		Chickens		0.0% 0	0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.7% 3	0.0% 0	0.0% 0
		Turkeys		0.0% 0	0.0% 0	0.7% 1	0.8% 1	0.0% 0	1.7% 1	0.0% 0	0.0% 0
		Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	20.3% 15	12.0% 9	19.8% 20	19.1% 17	21.5% 17	24.5% 25	19.0% 20	16.7% 16	19.4% 18
		Chicken Breasts							45.5% 5	0.0% 0	6.5% 2
		Ground Turkey							57.1% 12	43.8% 14	70.3% 26
		Ground Beef									
		Pork Chops							66.7% 2		100.0% 3
		Chickens		2.0% 1	7.7% 11	7.7% 23	20.1% 52	14.9% 49	11.7% 47	16.4% 37	15.0% 25
		Turkeys		14.3% 2	23.1% 9	38.1% 53	64.0% 80	54.2% 77	70.0% 42	84.2% 48	73.9% 34
		Cattle		0.0% 0	63.6% 7	60.7% 17	33.3% 2	40.0% 4	62.5% 5	55.6% 5	100.0% 1
		Swine		85.7% 6	73.0% 27	72.7% 24	81.8% 18	93.8% 15	72.7% 8	100.0% 11	75.0% 3

Ceftiofur Resistance

Figure 14. Percent of *Salmonella* Heidelberg Isolates from Humans, Retail Poultry, and Food Animals[1] Resistant to Ceftiofur, by Year, 1996-2004



[1] Data for ground beef, pork chops, and cattle are not included due to the small number of *Salmonella* Heidelberg isolates from these sources. Table 30 contains resistance data for *Salmonella* Heidelburg isolates from each source, by year

Table 31. Number of *Salmonella* Heidelberg Isolates Tested from Humans, Food Animals, and Retail Meats, by Year, 1996-2004

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Humans	74	75	101	89	79	102	105	96	93
Chicken Breasts							11	16	31
Ground Turkey							21	32	37
Ground Beef							0	0	0
Pork Chops							3	0	3
Chickens		51	143	297	259	329	403	226	167
Turkeys		14	39	139	125	142	60	57	46
Cattle		1	11	28	6	10	8	9	1
Swine		7	37	33	22	16	11	11	4

Table 32a. Resistance Patterns among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year		1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested	Humans	74	75	101	89	79	102	105	96	93
	Chicken Breasts							11	16	31
	Ground Turkey							21	32	37
	Ground Beef							0	0	0
	Pork Chops							3	0	3
	Chickens		51	143	297	259	329	403	226	167
	Turkeys		14	39	139	125	142	60	57	46
	Cattle		1	11	28	6	10	8	9	1
	Swine		7	37	33	22	16	11	11	4
Resistance Pattern	**Isolate Source**									
1. No Resistance Detected	Humans	54.1% 40	66.7% 50	56.4% 57	67.4% 60	63.3% 50	64.7% 66	67.6% 71	68.8% 66	55.9% 52
	Chicken Breasts							27.3% 3	62.5% 10	58.1% 18
	Ground Turkey							33.3% 7	50.0% 16	16.2% 6
	Ground Beef									
	Pork Chops							0.0% 0		0.0% 0
	Chickens		35.3% 18	50.3% 72	61.6% 183	48.3% 125	63.5% 209	66.5% 268	62.8% 142	68.3% 114
	Turkeys		50.0% 7	46.2% 18	43.2% 60	28.8% 36	31.0% 44	15.0% 9	8.8% 5	15.2% 7
	Cattle		100.0% 1	27.3% 3	25.0% 7	66.7% 4	60.0% 6	12.5% 1	44.4% 4	0.0% 0
	Swine		14.3% 1	18.9% 7	27.3% 9	13.6% 3	6.3% 1	27.3% 3	0.0% 0	0.0% 0
2. At Least ACSSuT[1] Resistant	Humans	1.4% 1	0.0% 0	0.0% 0	1.1% 1	1.3% 1	1.0% 1	1.0% 1	0.0% 0	1.1% 1
	Chicken Breasts							0.0% 0	0.0% 0	3.2% 1
	Ground Turkey							0.0% 0	0.0% 0	5.4% 2
	Ground Beef									
	Pork Chops							0.0% 0		0.0% 0
	Chickens		0.0% 0	0.7% 1	1.3% 4	11.2% 29	3.0% 10	1.5% 6	2.2% 5	2.4% 4
	Turkeys		0.0% 0	2.6% 1	0.7% 1	1.6% 2	2.8% 4	1.7% 1	0.0% 0	0.0% 0
	Cattle		0.0% 0	27.3% 3	42.9% 12	0.0% 0	0.0% 0	12.5% 1	33.3% 3	100.0% 1
	Swine		0.0% 0	0.0% 0	0.0% 0	4.5% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
3. At Least ACT/S[2] Resistant	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.0% 1	0.0% 0	0.0% 0
	Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
	Ground Turkey							0.0% 0	0.0% 0	0.0% 0
	Ground Beef									
	Pork Chops							0.0% 0		0.0% 0
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.4% 2	1.7% 1	0.0% 0	0.0% 0
	Cattle		0.0% 0	27.3% 3	42.9% 12	0.0% 0	0.0% 0	0.0% 0	44.4% 4	100.0% 1
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	9.1% 1	0.0% 0	0.0% 0

[1] ACSSuT = ampicillin, chloramphenicol, streptomycin, sulfamethoxazole/sulfisoxazole, and tetracycline

[2] ACT/S = ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole

Table 32b. Resistance Patterns among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1996-2004

Year		1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested	Humans	74	75	101	89	79	102	105	96	93
	Chicken Breasts							11	16	31
	Ground Turkey							21	32	37
	Ground Beef							0	0	0
	Pork Chops							3	0	3
	Chickens		51	143	297	259	329	403	226	167
	Turkeys		14	39	139	125	142	60	57	46
	Cattle		1	11	28	6	10	8	9	1
	Swine		7	37	33	22	16	11	11	4
Resistance Pattern	**Isolate Source**									
4. At Least ACSSuTAuCf[1] Resistant	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.3% 1	1.0% 1	1.0% 1	0.0% 0	0.0% 0
	Chicken Breasts							0.0% 0	0.0% 0	3.2% 1
	Ground Turkey							0.0% 0	0.0% 0	5.4% 2
	Ground Beef									
	Pork Chops							0.0% 0		0.0% 0
	Chickens		0.0% 0	0.7% 1	0.7% 2	11.2% 29	2.7% 9	1.5% 6	2.2% 5	2.4% 4
	Turkeys		0.0% 0	2.6% 1	0.7% 1	0.8% 1	2.8% 4	1.7% 1	0.0% 0	0.0% 0
	Cattle		0.0% 0	27.3% 3	42.9% 12	0.0% 0	0.0% 0	12.5% 1	33.3% 3	100.0% 1
	Swine		0.0% 0	0.0% 0	0.0% 0	4.5% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
5. At Least Ceftiofur and Nalidixic Acid Resistant	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Chicken Breasts							0.0% 0	0.0% 0	0.0% 0
	Ground Turkey							0.0% 0	0.0% 0	0.0% 0
	Ground Beef									
	Pork Chops							0.0% 0		0.0% 0
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.7% 3	0.0% 0	0.0% 0
	Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.7% 1	0.0% 0	0.0% 0
	Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0

[1] ACSSuTAuCf = ACSSuT, amoxicillin-clavulanic acid, and ceftiofur

IV. *Campylobacter* Data

A. C*ampylobacter jejuni* and *Campylobacter coli* Isolates Tested

Table 33. Number of *Campylobacter jejuni* Isolates Tested, by Source and Year, 1997-2004

Source	Year							
	1997	1998	1999	2000	2001	2002	2003	2004
Humans	209	297	293	306	365	329	303	320
Chicken Breasts						198	325	510
Ground Turkey						2	4	7
Ground Beef						0	1	0
Pork Chops						2	0	0
Chickens					64[1]	526	374	508

[1] These isolates were recovered from July through December 2001, when the new ARS isolation method was used

Table 34. Number of *Campylobacter coli* Isolates Tested, by Source and Year, 1997-2004

Source	Year							
	1997	1998	1999	2000	2001	2002	2003	2004
Humans	6	8	20	12	17	25	22	26
Chicken Breasts						90	142	196
Ground Turkey						2	1	5
Ground Beef						0	0	0
Pork Chops						3	4	3
Chickens					52[1]	288	247	186

[1] These isolates were recovered from July through December 2001, when the new ARS isolation method was used

B. Isolation of *Campylobacter* from Retail Meats

Table 35. Number and Percent of Retail Meat Samples Positive for *Campylobacter*, 2004

	Chicken Breast	Ground Turkey	Ground Beef	Pork Chops
Number of Meat Samples Tested	1172	1165	1186	1176
Number Positive for *Campylobacter*	706	12	0	3
Percent Positive for *Campylobacter*	60.2%	1.0%	0.0%	0.3%

Figure 15. Percent of Retail Meat Samples Positive for *Campylobacter*, 2004

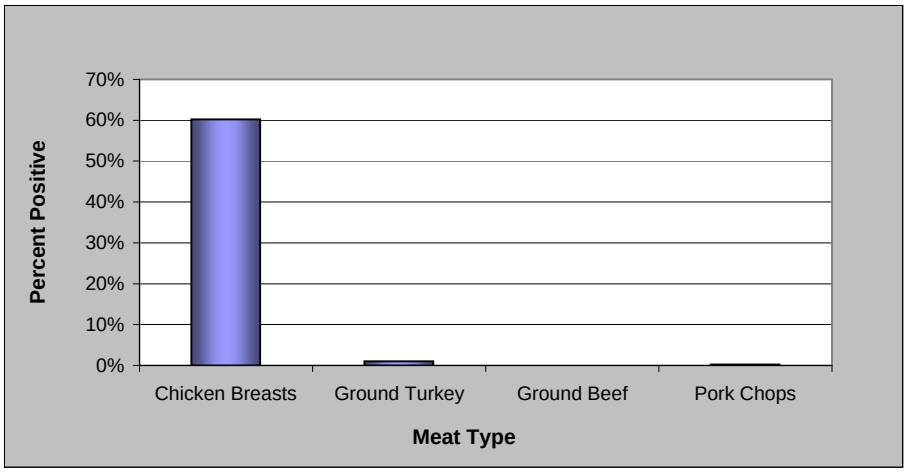
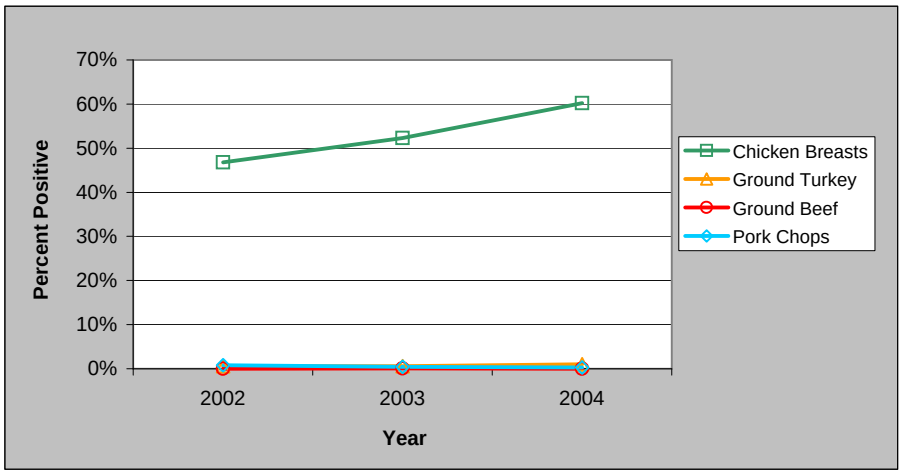


Figure 16. Percent of Retail Meat Samples Positive for *Campylobacter*, 2002-2004

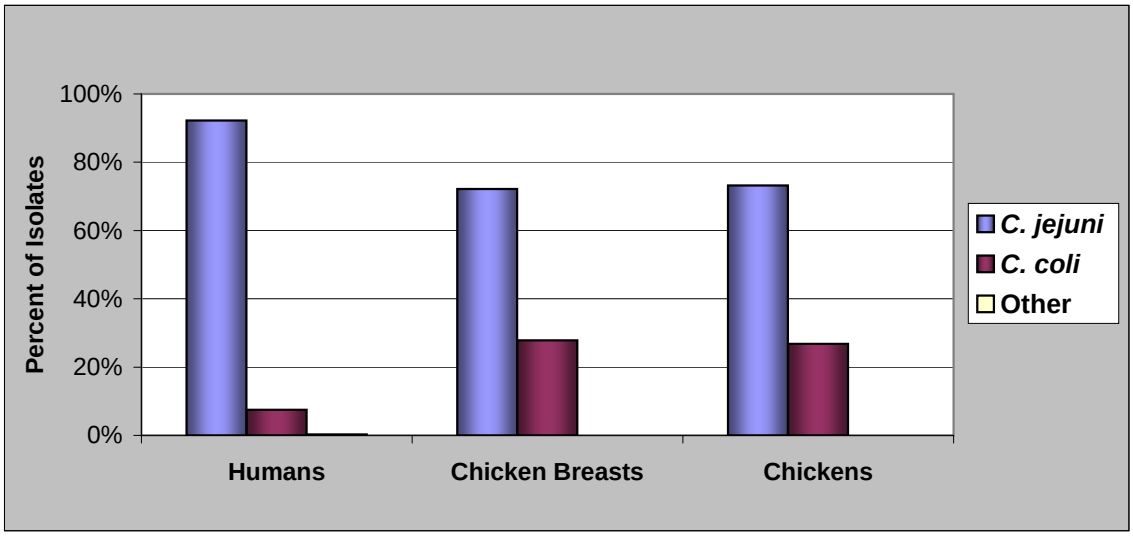


C. *Campylobacter* Species

Table 36. *Campylobacter* Species Isolated from Humans, Retail Meats, and Chickens, 2004

	Humans	Retail Meats				Food Animals
***Campylobacter* Species**	**Humans (n=347)**	**Chicken Breast (n=706)**	**Ground Turkey (n=12)**	**Ground Beef (n=0)**	**Pork Chops (n=3)**	**Chickens (n=694)**
C. jejuni	92.2% 320	72.2% 510	58.3% 7	0.0% 0	0.0% 0	73.2% 508
C. coli	7.5% 26	27.8% 196	41.7% 5	0.0% 0	100.0% 3	26.8% 186
Other	0.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0

Figure 17. *Campylobacter* Species Isolated from Humans, Chicken Breasts, and Chickens, 2004



D. Antimicrobial Susceptibility among *Campylobacter jejuni*

MIC Distributions

Table 37. Distribution of MICs and Occurrence of Resistance among *Campylobacter jejuni* Isolates from Humans, Retail Meats, and Chickens, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5]																		
					0.002	0.004	0.008	0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512
Aminoglycosides																							
Gentamicin	Humans (320)	1.9	**0.3**	[0.0 - 1.7]						0.3		9.4	45.3	28.8	14.1	1.9							**0.3**
	Chicken Breasts (510)	0.0	**0.0**	[0.0 - 0.7]							1.8	5.1	85.1	8.0									
	Ground Turkey (7)	0.0	**0.0**	[0.0 - 41.0]								14.3	85.7										
	Chickens (508)	0.0	**0.2**	[0.0 - 1.1]					2.8	7.7	38.2	39.6	10.8	0.8			**0.2**						
Ketolides																							
Telithromycin	Chicken Breasts (510)	0.4	**0.4**	[0.0 - 1.4]				0.2		0.4	0.2	13.1	56.5	23.7	4.9	0.2	0.4	**0.4**					
	Ground Turkey (7)	0.0	**0.0**	[0.0 - 41.0]								14.3	28.6	57.1									
Lincosamides																							
Clindamycin	Humans (320)	0.3	**2.2**	[0.9 - 4.5]				0.3	0.3	2.2	25.3	48.1	18.1	2.2	0.9	0.3	**0.3**	**1.3**		**0.6**			
	Chicken Breasts (510)	0.0	**0.4**	[0.0 - 1.4]					0.6	10.2	55.5	29.6	2.0	1.2	0.6			**0.4**					
	Ground Turkey (7)	0.0	**0.0**	[0.0 - 41.0]							42.9	42.9		14.3									
	Chickens (508)	0.6	**0.2**	[0.0 - 1.1]				0.2	3.7	16.5	38.2	30.9	7.1	2.0	0.6	0.6							**0.2**
Macrolides																							
Azithromycin	Humans (320)	1.6	**0.6**	[0.1 - 2.2]						5.9	40.3	44.4	5.3	1.6	0.3	1.6				**0.3**			**0.3**
	Chicken Breasts (510)	0.0	**0.8**	[0.2 - 2.0]				4.9	49.6	38.2	5.3	0.2	0.2	0.6	0.2						**0.8**		
	Ground Turkey (7)	0.0	**0.0**	[0.0 - 41.0]				14.3	14.3	57.1	14.3												
	Chickens (508)	0.0	**1.6**	[0.7 - 3.1]				12.6	46.5	29.9	8.3	0.8	0.4										**1.6**
Erythromycin	Humans (320)	0.3	**0.3**	[0.0 - 1.7]						0.6	0.9	10.0	49.7	28.4	7.8	1.6	0.3	0.3					**0.3**
	Chicken Breasts (510)	0.0	**0.8**	[0.2 - 2.0]						0.4	2.5	53.1	35.3	7.8							**0.8**		
	Ground Turkey (7)	0.0	**0.0**	[0.0 - 41.0]							14.3	14.3	28.6	42.9									
	Chickens (508)	0.4	**1.2**	[0.4 - 2.6]				0.2	0.2	2.2	22.0	43.9	24.6	5.3				0.4					**1.2**
Phenicols																							
Chloramphenicol	Humans (320)	3.1	**1.6**	[0.5 - 3.6]								0.6	2.5	45.9	35.3	8.4	2.5	3.1	**1.6**				
	Chickens (508)	0.0	**0.0**	[0.0 - 0.7]							0.2	2.0	21.3	52.8	20.9	2.8	0.2						
Florfenicol[6]	Chicken Breasts (510)	N/A	**0.0**	[0.0 - 0.7]							0.6		5.1	85.9	8.0	0.4							
	Ground Turkey (7)	N/A	**0.0**	[0.0 - 41.0]									28.6	14.3	57.1								
Quinolones																							
Ciprofloxacin	Humans (320)	0.0	**18.1**	[14.1 - 22.8]			0.6	0.9	35.9	37.8	5.6	0.9						**1.6**		**16.6**			
	Chicken Breasts (510)	0.0	**15.1**	[12.1 - 18.5]					0.2	39.8	37.3	7.6				**0.4**	**9.0**	**4.5**	**1.2**				
	Ground Turkey (7)	0.0	**28.6**	[3.7 - 71.0]						28.6	42.9								**28.6**				
	Chickens (508)	0.0	**21.3**	[17.8 - 25.1]			0.8	5.9	34.8	32.7	4.1	0.2		0.2		**0.4**	**0.4**	**0.6**		**19.9**			
Nalidixic acid	Humans (320)	0.6	**18.4**	[14.3 - 23.1]									0.6	11.9	39.4	20.6	6.9	1.6	0.6	**0.3**			**18.1**
	Chicken Breasts (510)	0.2	**15.1**	[12.1 - 18.5]												64.3	20.4		0.2	**0.4**	**14.7**		
	Ground Turkey (7)	0.0	**28.6**	[3.7 - 71.0]												42.9	28.6				**28.6**		
	Chickens (508)	0.4	**21.7**	[18.1 - 25.5]										0.4	15.0	40.0	17.5	5.1	0.4	**0.4**	**0.2**		**21.1**
Tetracyclines																							
Tetracycline	Humans (320)	0.3	**46.9**	[41.3 - 52.5]					2.2	22.2	21.3	5.3	1.3	0.3		0.3	0.3	**1.6**	**4.7**	**5.6**	**5.6**	**1.3**	**28.1**
	Chicken Breasts (510)	0.2	**50.2**	[45.8 - 54.6]						0.6	24.3	15.3	7.6	1.8			0.2	**2.2**	**4.9**	**25.9**	**17.3**		
	Ground Turkey (7)	0.0	**42.9**	[9.9 - 81.6]							14.3	28.6	14.3							**14.3**	**28.6**		
	Chickens (508)	0.6	**42.3**	[38.0 - 46.8]					0.2	1.6	14.8	17.1	15.6	5.7	1.8	0.4	0.6	**3.0**	**2.6**	**6.9**	**2.6**		**27.4**

[1] There were no *C. jejuni* isolates from ground beef or pork chops

[2] Percent of isolates with intermediate susceptibility

[3] Percent resistant; for florfenicol, percent non-susceptible

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. Etest was used to test human and food animal isolates while a broth microdilution method was used to test retail meat isolates. Isolates with an MIC of 0.016 µg/ml by Etest are included in the 0.015 µg/ml column

[6] For florfenicol, only a susceptible breakpoint (≤ 4 µg/ml) has been established. In this report, isolates with an MIC ≥ 8 µg/ml are categorized as resistant

Resistance by Year

Table 38a. Antimicrobial Resistance among *Campylobacter jejuni* Isolates from Humans, Retail Meats, and Chickens, by Year, 1997-2004

Year			1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	209	297	293	306	365	329	303	320
		Chicken Breasts						198	325	510
		Ground Turkey						2	4	7
		Ground Beef						0	1	0
		Pork Chops						2	0	0
		Chickens					64[1]	526	374	508
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**								
Aminoglycosides	Gentamicin (MIC ≥ 8 µg/ml)	Humans		0.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.3% 1
		Chicken Breasts						0.0% 0	0.3% 1	0.0% 0
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	
		Pork Chops						0.0% 0		
		Chickens					0.0% 0	0.0% 0	0.0% 0	0.2% 1
Ketolides	Telithromycin (MIC ≥ 16 µg/ml)	Chicken Breasts								0.4% 2
		Ground Turkey								0.0% 0
		Ground Beef								
		Pork Chops								
Lincosamides	Clindamycin (MIC ≥ 8 µg/ml)	Humans	1.0% 2	1.0% 3	0.7% 2	0.7% 2	1.9% 7	1.8% 6	0.0% 0	2.2% 7
		Chicken Breasts								0.4% 2
		Ground Turkey								0.0% 0
		Ground Beef								
		Pork Chops								
		Chickens					0.0% 0	0.4% 2	0.8% 3	0.2% 1
Macrolides	Azithromycin (MIC ≥ 8 µg/ml)	Humans		0.3% 1	1.7% 5	1.6% 5	1.9% 7	1.8% 6	0.3% 1	0.6% 2
		Chicken Breasts								0.8% 4
		Ground Turkey								0.0% 0
		Ground Beef								
		Pork Chops								
		Chickens					3.1% 2	0.6% 3	1.3% 5	1.6% 8
	Erythromycin (MIC ≥ 32 µg/ml)	Humans	1.4% 3	0.7% 2	1.4% 4	1.0% 3	1.9% 7	1.2% 4	0.3% 1	0.3% 1
		Chicken Breasts						0.0% 0	0.0% 0	0.8% 4
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0
		Ground Beef							0.0% 0	
		Pork Chops						0.0% 0		
		Chickens					3.1% 2	0.6% 3	1.6% 6	1.2% 6

[1] These isolates were recovered from July through December 2001, when the new ARS isolation method was used

Table 38b. Antimicrobial Resistance among *Campylobacter jejuni* Isolates from Humans, Retail Meats, and Chickens, by Year, 1997-2004

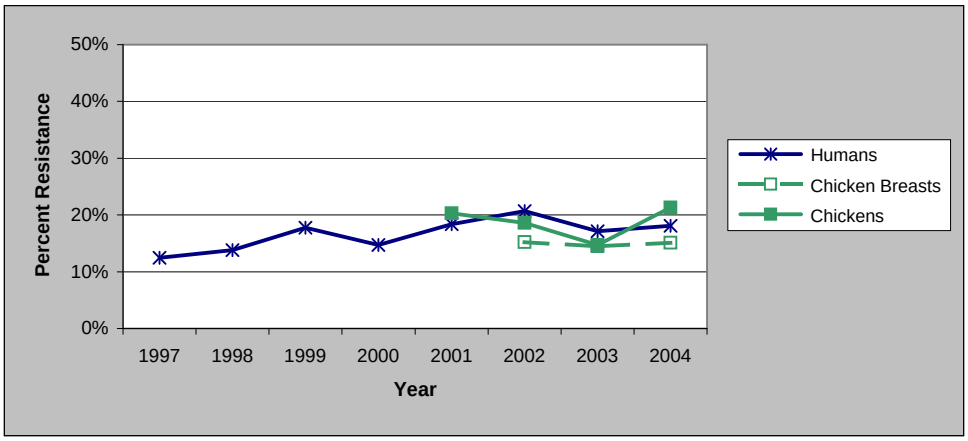
Year			1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	209	297	293	306	365	329	303	320
		Chicken Breasts						198	325	510
		Ground Turkey						2	4	7
		Ground Beef						0	1	0
		Pork Chops						2	0	0
		Chickens					64[1]	526	374	508
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**								
Phenicols	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	3.8% 8	1.0% 3	0.7% 2	0.0% 0	0.3% 1	0.3% 1	0.0% 0	1.6% 5
		Chickens					0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Flofenicol (MIC ≥ 8)[2]	Chicken Breasts								0.0% 0
		Ground Turkey								0.0% 0
		Ground Beef								
		Pork Chops								
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	12.4% 26	13.8% 41	17.7% 52	14.7% 45	18.4% 67	20.7% 68	17.2% 52	18.1% 58
		Chicken Breasts						15.2% 30	14.5% 47	15.1% 77
		Ground Turkey						50.0% 1	0.0% 0	28.6% 2
		Ground Beef							0.0% 0	
		Pork Chops						0.0% 0		
		Chickens					20.3% 13	18.6% 98	14.7% 55	21.3% 108
	Nalidixic acid (MIC ≥ 64 µg/ml)	Humans	13.4% 28	15.5% 46	20.1% 59	16.0% 49	18.9% 69	21.3% 70	17.8% 54	18.4% 59
		Chicken Breasts								15.1% 77
		Ground Turkey								28.6% 2
		Ground Beef								
		Pork Chops								
		Chickens					20.3% 13	22.1% 116	15.5% 58	21.7% 110
Tetracyclines	Doxycycline (MIC ≥ 8 µg/ml)	Chicken Breasts						38.4% 76	40.6% 132	
		Ground Turkey						100.0% 2	75.0% 3	
		Ground Beef							0.0% 0	
		Pork Chops						0.0% 0		
	Tetracycline (MIC ≥ 16 µg/ml)	Humans	47.8% 100	46.1% 137	45.4% 133	39.2% 120	40.3% 147	41.3% 136	38.3% 116	46.9% 150
		Chicken Breasts								50.2% 256
		Ground Turkey								42.9% 3
		Ground Beef								
		Pork Chops								
		Chickens					35.9% 23	45.1% 237	47.6% 178	42.3% 215

[1] These isolates were recovered from July through December 2001, when the new ARS isolation method was used

[2] For florfenicol, only a susceptible breakpoint (≤ 4 µg/ml) has been established. In this report, isolates with an MIC ≥ 8 µg/ml are categorized as resistant

Ciprofloxacin Resistance

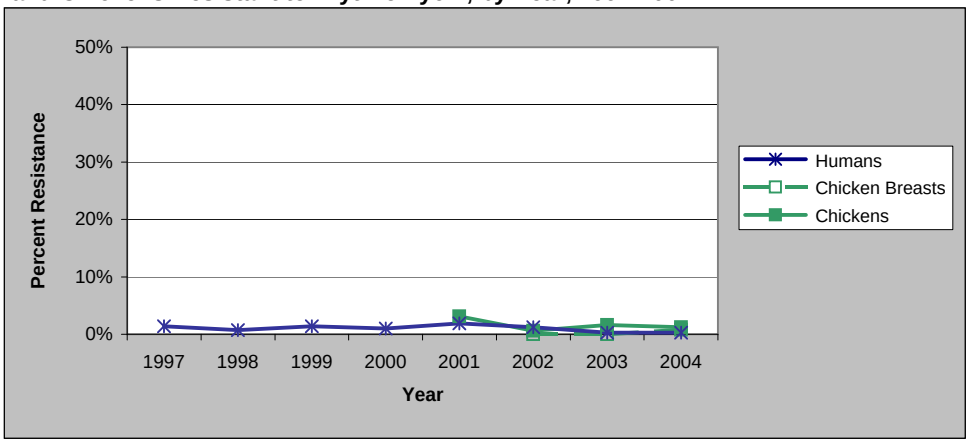
Figure 18. Percent of *Campylobacter jejuni* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Ciprofloxacin, by Year, 1997-2004



[1] Data for ground turkey, ground beef, and pork chops are not included due to the small number of *C. jejuni* isolates from these sources. Table 38 contains resistance data for *C. jejuni* isolates from each source, by year

Erythromycin Resistance

Figure 19. Percent of *Campylobacter jejuni* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Erythromycin, by Year, 1997-2004



[1] Data for ground turkey, ground beef, and pork chops are not included due to the small number of *C. jejuni* isolates from these sources. Table 38 contains resistance data for *C. jejuni* isolates from each source, by year

Table 39. Number of *Campylobacter jejuni* Isolates Tested from Humans, Retail Meats, and Chickens, by Year, 1997-2004

	1997	1998	1999	2000	2001	2002	2003	2004
Humans	209	297	293	306	365	329	303	320
Chicken Breasts						198	325	510
Ground Turkey						2	4	7
Ground Beef						0	1	0
Pork Chops						2	0	0
Chickens					64[1]	526	374	508

[1] These isolates were recovered from July through December 2001, when the new ARS isolation method was used

E. Antimicrobial Susceptibility among *Campylobacter coli*

MIC Distributions

Table 40. Distribution of MICs and Occurrence of Resistance among *Campylobacter coli* Isolates from Humans, Retail Meats, and Chickens, 2004

Antimicrobial	Isolate Source (# of Isolates)[1]	%I[2]	%R[3]	[95% CI][4]	Distribution (%) of MICs (µg/ml)[5]																
					0.002	0.004	0.008	0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512
Aminoglycosides																						
Gentamicin	Humans (26)	3.8	**0.0**	[0.0 - 13.2]								7.7	30.8	42.3	15.4	3.8						
	Chicken Breasts (196)	0.0	**0.0**	[0.0 - 1.9]							0.5	4.1	85.7	9.7								
	Ground Turkey (5)	0.0	**0.0**	[0.0 - 52.2]									40.0	60.0								
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]										100.0								
	Chickens (186)	0.0	**0.0**	[0.0 - 2.0]						0.5	5.9	43.0	48.4	2.2								
Ketolides																						
Telithromycin	Chicken Breasts (196)	2.6	**8.2**	[4.7 - 12.9]				0.5			1.0	20.4	5.6	18.9	35.7	7.1	2.6	**8.2**				
	Ground Turkey (5)	0.0	**0.0**	[0.0 - 52.2]										100.0								
	Pork Chops (3)	33.3	**0.0**	[0.0 - 70.8]								33.3		33.3			33.3					
Lincosamides																						
Clindamycin	Humans (26)	0.0	**0.0**	[0.0 - 13.2]								53.8	19.2	15.4	11.5							
	Chicken Breasts (196)	2.0	**7.1**	[4.0 - 11.7]						1.5	19.4	51.0	14.3	4.6		2.0	**3.1**	**4.1**				
	Ground Turkey (5)	0.0	**0.0**	[0.0 - 52.2]									20.0	80.0								
	Pork Chops (3)	0.0	**33.3**	[0.8 - 90.6]								66.7						**33.3**				
	Chickens (186)	5.9	**1.1**	[0.1 - 3.8]				0.5	4.8	17.7	30.1	26.9	5.9	2.7	4.3	5.9	**0.5**	**0.5**				
Macrolides																						
Azithromycin	Humans (26)	0.0	**0.0**	[0.0 - 13.2]							34.6	46.2	15.4		3.8							
	Chicken Breasts (196)	0.0	**9.2**	[5.5 - 14.1]					14.3	42.9	29.6	3.1	0.5	0.5							**9.2**	
	Ground Turkey (5)	0.0	**0.0**	[0.0 - 52.2]							100.0											
	Pork Chops (3)	0.0	**33.3**	[0.8 - 90.6]				33.3		33.3											**33.3**	
	Chickens (186)	0.0	**9.1**	[5.4 - 14.2]				1.6	30.6	39.8	16.7	1.6	0.5									**9.1**
Erythromycin	Humans (26)	3.8	**0.0**	[0.0 - 13.2]								15.4	34.6	15.4	26.9	3.8		3.8				
	Chicken Breasts (196)	0.0	**9.2**	[5.5 - 14.1]							1.0	21.9	17.3	39.8	8.7	1.5	0.5				**9.2**	
	Ground Turkey (5)	0.0	**0.0**	[0.0 - 52.2]										100.0								
	Pork Chops (3)	0.0	**33.3**	[0.8 - 90.6]								33.3		33.3							**33.3**	
	Chickens (186)	0.0	**9.1**	[5.4 - 14.2]					1.1	0.5	16.7	22.0	30.1	18.8	1.6							**9.1**
Phenicols																						
Chloramphenicol	Humans (26)	0.0	**0.0**	[0.0 - 13.2]										7.7	38.5	38.5	15.4					
	Chickens (186)	0.0	**0.0**	[0.0 - 2.0]									3.8	38.2	50.5	7.0	0.5					
Florfenicol[6]	Chicken Breasts (196)	N/A	**0.0**	[0.0 - 1.9]									1.5	64.3	33.7	0.5						
	Ground Turkey (5)	N/A	**0.0**	[0.0 - 52.2]										20.0	80.0							
	Pork Chops (3)	N/A	**0.0**	[0.0 - 70.8]										66.7		33.3						
Quinolones																						
Ciprofloxacin	Humans (26)	0.0	**30.8**	[14.3 - 51.8]					26.9	15.4	19.2	3.8	3.8				**3.8**			**26.9**		
	Chicken Breasts (196)	0.0	**16.3**	[11.4 - 22.3]						23.0	36.7	23.5		0.5			**2.0**	**12.8**	**1.5**			
	Ground Turkey (5)	0.0	**0.0**	[0.0 - 52.2]						20.0	80.0											
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]							100.0											
	Chickens (186)	0.0	**26.9**	[20.7 - 33.9]				2.7	11.8	37.6	18.8	2.2				**0.5**	**0.5**	**0.5**		**25.3**		
Nalidixic acid	Humans (26)	0.0	**34.6**	[17.2 - 55.7]											19.2	30.8	7.7	7.7				**34.6**
	Chicken Breasts (196)	0.0	**16.3**	[11.4 - 22.3]												47.4	34.7	1.5		**3.6**	**12.8**	
	Ground Turkey (5)	0.0	**0.0**	[0.0 - 52.2]												20.0	80.0					
	Pork Chops (3)	0.0	**0.0**	[0.0 - 70.8]													66.7	33.3				
	Chickens (186)	1.1	**27.4**	[21.1 - 34.4]											1.6	26.3	37.1	6.5	1.1	**1.1**		**26.3**
Tetracyclines																						
Tetracycline	Humans (26)	0.0	**38.5**	[20.2 - 59.4]							42.3	15.4		3.8					**3.8**	**7.7**	**7.7**	**19.2**
	Chicken Breasts (196)	0.0	**46.4**	[39.3 - 53.7]							6.6	21.4	9.7	9.7	5.6	0.5			**1.0**	**2.6**	**42.9**	
	Ground Turkey (5)	0.0	**0.0**	[0.0 - 52.2]										60.0	40.0							
	Pork Chops (3)	0.0	**66.7**	[9.4 - 99.2]									33.3								**66.7**	
	Chickens (186)	0.0	**48.4**	[41.0 - 55.8]							3.8	7.0	16.7	18.3	5.4	0.5		**0.5**	**1.6**	**2.7**	**3.2**	**40.3**

[1] There were no *C. coli* isolates from ground beef

[2] Percent of isolates with intermediate susceptibility

[3] Percent resistant; for florfenicol, percent non-susceptible

[4] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. Etest was used to test human and food animal isolates while a broth microdilution method was used to test retail meat isolates. Isolates with an MIC of 0.016 µg/ml by Etest are included in the 0.015 µg/ml column

[6] For florfenicol, only a susceptible breakpoint (≤ 4 µg/ml) has been established. In this report, isolates with an MIC≥ 8 µg/ml are categorized as resistant

Resistance by Year

Table 41a. Antimicrobial Resistance among *Campylobacter coli* Isolates from Humans, Retail Meats, and Chickens, by Year, 1997-2004

Year			1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	6	8	20	12	17	25	22	26
		Chicken Breasts						90	142	196
		Ground Turkey						2	1	5
		Ground Beef						0	0	0
		Pork Chops						3	4	3
		Chickens					52[1]	288	247	186
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**								
Aminoglycosides	Gentamicin (MIC ≥ 8 µg/ml)	Humans		0.0% 0	0.0% 0	8.3% 1	0.0% 0	0.0% 0	4.5% 1	0.0% 0
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0
		Ground Beef								
		Pork Chops						0.0% 0	0.0% 0	0.0% 0
		Chickens					0.0% 0	0.0% 0	0.0% 0	0.0% 0
Ketolides	Telithromycin (MIC ≥ 16 µg/ml)	Chicken Breasts								8.2% 16
		Ground Turkey								0.0% 0
		Ground Beef								
		Pork Chops								0.0% 0
Lincosamides	Clindamycin (MIC ≥ 8 µg/ml)	Humans	16.7% 1	12.5% 1	10.0% 2	8.3% 1	5.9% 1	4.0% 1	9.1% 2	0.0% 0
		Chicken Breasts								7.1% 14
		Ground Turkey								0.0% 0
		Ground Beef								
		Pork Chops								33.3% 1
		Chickens					1.9% 1	4.9% 14	4.5% 11	1.1% 2
Macrolides	Azithromycin (MIC ≥ 8 µg/ml)	Humans		12.5% 1	10.0% 2	8.3% 1	5.9% 1	4.0% 1	9.1% 2	0.0% 0
		Chicken Breasts								9.2% 18
		Ground Turkey								0.0% 0
		Ground Beef								
		Pork Chops								33.3% 1
		Chickens					11.5% 6	19.4% 56	20.2% 50	9.1% 17
	Erythromycin (MIC ≥ 32 µg/ml)	Humans	0.0% 0	12.5% 1	10.0% 2	8.3% 1	5.9% 1	4.0% 1	9.1% 2	0.0% 0
		Chicken Breasts						7.8% 7	7.0% 10	9.2% 18
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0
		Ground Beef								
		Pork Chops						33.3% 1	75.0% 3	33.3% 1
		Chickens					9.6% 5	18.8% 54	20.2% 50	9.1% 17

[1] These isolates were recovered from July through December 2001, when the new ARS isolation method was used

Table 41b. Antimicrobial Resistance among *Campylobacter coli* Isolates from Humans, Retail Meats, and Chickens, by Year, 1997-2004

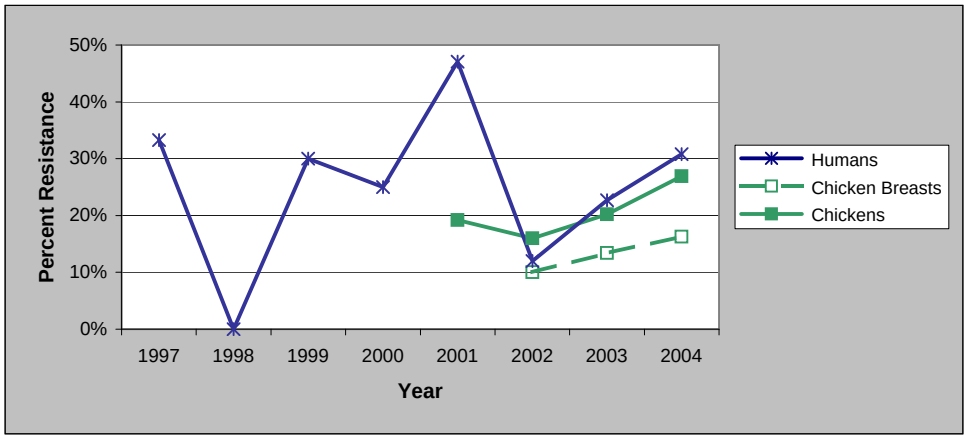
Year			1997	1998	1999	2000	2001	2002	2003	2004
Number of Isolates Tested		Humans	6	8	20	12	17	25	22	26
		Chicken Breasts						90	142	196
		Ground Turkey						2	1	5
		Ground Beef						0	0	0
		Pork Chops						3	4	3
		Chickens					52[1]	288	247	186
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**								
Phenicols	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	50.0% 3	37.5% 3	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chickens					0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Flofenicol (MIC > 4)[2]	Chicken Breasts								0.0% 0
		Ground Turkey								0.0% 0
		Ground Beef								
		Pork Chops								0.0% 0
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	33.3% 2	0.0% 0	30.0% 6	25.0% 3	47.1% 8	12.0% 3	22.7% 5	30.8% 8
		Chicken Breasts						10.0% 9	13.4% 19	16.3% 32
		Ground Turkey						50.0% 1	100.0% 1	0.0% 0
		Ground Beef								
		Pork Chops						0.0% 0	0.0% 0	0.0% 0
		Chickens					19.2% 10	16.0% 46	20.2% 50	26.9% 50
	Nalidixic acid (MIC ≥ 64 µg/ml)	Humans	50.0% 3	50.0% 4	30.0% 6	25.0% 3	47.1% 8	12.0% 3	22.7% 5	34.6% 9
		Chicken Breasts								16.3% 32
		Ground Turkey								0.0% 0
		Ground Beef								
		Pork Chops								0.0% 0
		Chickens					19.2% 10	17.7% 51	21.5% 53	27.4% 51
Tetracyclines	Doxycycline (MIC ≥ 8 µg/ml)	Chicken Breasts						44.4% 40	50.7% 72	
		Ground Turkey						50.0% 1	100.0% 1	
		Ground Beef								
		Pork Chops						33.3% 1	75.0% 3	
	Tetracycline (MIC ≥ 16 µg/ml)	Humans	66.7% 4	50.0% 4	30.0% 6	25.0% 3	58.8% 10	40.0% 10	45.5% 10	38.5% 10
		Chicken Breasts								46.4% 91
		Ground Turkey								0.0% 0
		Ground Beef								
		Pork Chops								66.7% 2
		Chickens					57.7% 30	49.0% 141	51.0% 126	48.4% 90

[1] These isolates were recovered from July through December 2001, when the new ARS isolation method was used

[2] For florfenicol, only a susceptible breakpoint (≤ 4 µg/ml) has been established. In this report, isolates with an MIC ≥ 8 µg/ml are categorized as resistant

Ciprofloxacin Resistance

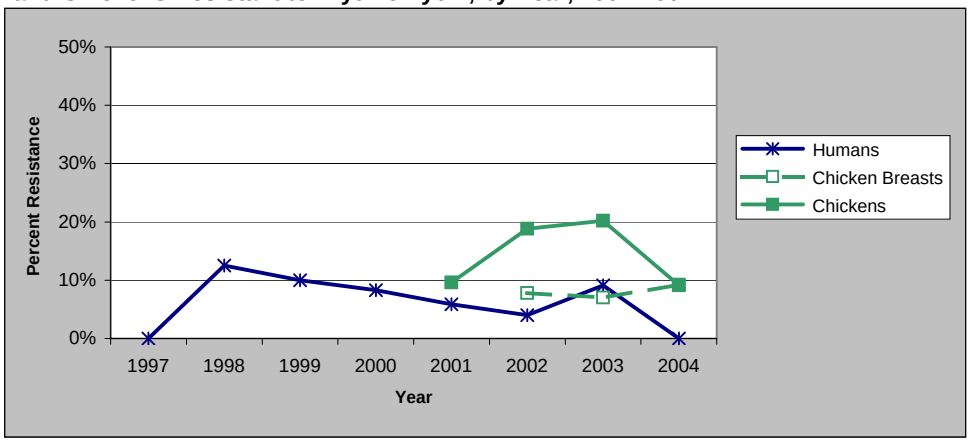
Figure 20. Percent of *Campylobacter coli* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Ciprofloxacin, by Year, 1997-2004



[1] Data for ground turkey and pork chops are not included due to the small number of *C. coli* isolates from these sources. There were no *C. coli* isolates from ground beef. Table 41 contains resistance data for *C. coli* isolates from each source, by year

Erythromycin Resistance

Figure 21. Percent of *Campylobacter coli* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Erythromycin, by Year, 1997-2004



[1] Data for ground turkey and pork chops are not included due to the small number of *C. coli* isolates from these sources. There were no *C. coli* isolates from ground beef. Table 41 contains resistance data for *C. coli* isolates from each source, by year

Table 42. Number of *Campylobacter coli* Isolates Tested from Humans, Retail Meats, and and Chickens, by Year, 1997-2004

	1997	1998	1999	2000	2001	2002	2003	2004
Humans	6	8	20	12	17	25	22	26
Chicken Breasts						90	142	196
Ground Turkey						2	1	5
Ground Beef						0	0	0
Pork Chops						3	4	3
Chickens					52[1]	288	247	186

[1] These isolates were recovered from July through December 2001, when the new ARS isolation method was used

V. *Escherichia coli* Data

A. *Escherichia coli* Isolates Tested

Table 43. Number of *E. coli* Isolates Tested, by Source and Year, 2000-2004

	Year				
Source	**2000**	**2001**	**2002**	**2003**	**2004**
Chicken Breasts			282	396	400
Ground Turkey			304	333	376
Ground Beef			295	311	338
Pork Chops			184	218	232
Chickens	285	1989	2100	1365	1697

B. Isolation of *E. coli* from Retail Meats

Table 44. Number and Percent of Retail Meat Samples Positive for *E. coli*, 2004

	Chicken Breasts	Ground Turkey	Ground Beef	Pork Chops
Number of Meat Samples Tested	476	466	480	478
Number Positive for *E. coli*	400	376	338	232
Percent Positive for *E. coli*	84.0%	80.7%	70.4%	48.5%

Figure 22. Percent of Retail Meat Samples Positive for *E. coli*, 2004

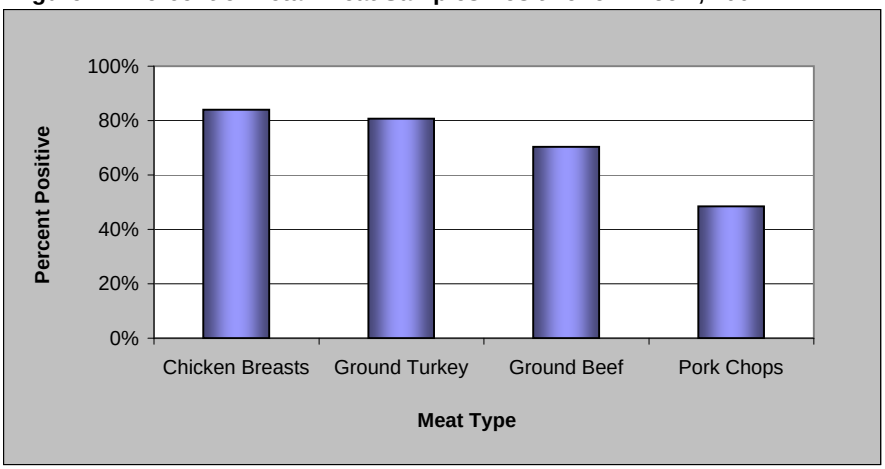
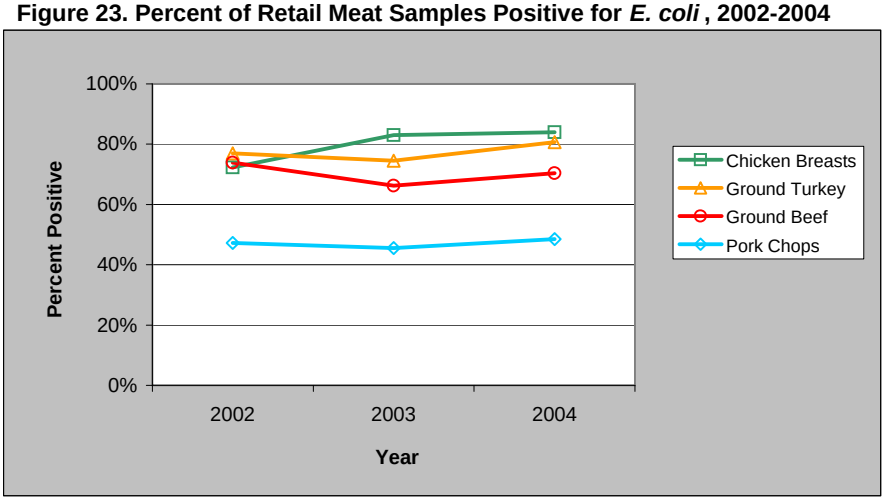


Figure 23. Percent of Retail Meat Samples Positive for *E. coli*, 2002-2004



C. Antimicrobial Susceptibility among *E. coli*

MIC Distributions

Table 45a. Distribution of MICs and Occurrence of Resistance among *E. coli* Isolates from Retail Meats and Chickens, 2004

Antimicrobial	Isolate Source (# of Isolates)	%I[1]	%R[2]	[95% CI][3]	Distribution (%) of MICs (µg/ml)[4] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Aminoglycosides																					
Amikacin	Chicken Breasts (400)	0.0	**0.0**	[0.0 - 0.9]							15.0	65.0	17.0	2.5	0.5						
	Ground Turkey (376)	0.0	**0.0**	[0.0 - 1.0]							17.3	66.5	13.8	2.4							
	Ground Beef (338)	0.0	**0.0**	[0.0 - 1.1]							15.7	69.8	12.4	1.8	0.3						
	Pork Chops (232)	0.0	**0.0**	[0.0 - 1.6]						0.4	15.5	56.0	26.3	1.3	0.4						
	Chickens (1697)	0.0	**0.0**	[0.0 - 0.2]						1.6	15.3	48.9	28.5	5.5	0.1						
Gentamicin	Chicken Breasts (400)	2.8	**30.0**	[25.5 - 34.8]					5.8	43.3	14.8	2.5	1.0	2.8	**10.0**	**20.0**					
	Ground Turkey (376)	2.1	**29.3**	[24.7 - 34.1]					4.8	42.6	19.1	2.1		2.1	**12.5**	**16.8**					
	Ground Beef (338)	0.0	**0.6**	[0.1 - 2.1]					9.2	67.8	20.7	1.8				**0.6**					
	Pork Chops (232)	0.4	**1.3**	[0.3 - 3.7]					10.3	57.8	26.7	3.4		0.4		**1.3**					
	Chickens (1697)	2.9	**39.1**	[36.7 - 41.4]					5.8	26.8	20.9	3.9	0.7	2.9	**8.6**	**30.5**					
Kanamycin	Chicken Breasts (400)	1.0	**6.8**	[4.5 - 9.7]										81.8	10.5	1.0		**6.8**			
	Ground Turkey (376)	2.1	**16.0**	[12.4 - 20.1]										75.0	6.9	2.1	**0.3**	**15.7**			
	Ground Beef (338)	0.0	**2.4**	[1.0 - 4.6]										95.6	2.1			**2.4**			
	Pork Chops (232)	0.0	**8.2**	[5.0 - 12.5]										89.2	2.6			**8.2**			
	Chickens (1697)	6.0	**11.5**	[10.1 - 13.2]										67.8	14.7	6.0	**1.9**	**9.7**			
Streptomycin	Chicken Breasts (400)	N/A	**56.8**	[51.7 - 61.7]												43.3	**13.0**	**43.8**			
	Ground Turkey (376)	N/A	**49.2**	[44.0 - 54.4]												50.8	**18.6**	**30.6**			
	Ground Beef (338)	N/A	**11.8**	[8.6 - 15.8]												88.2	**4.7**	**7.1**			
	Pork Chops (232)	N/A	**21.1**	[16.1 - 26.9]												78.9	**8.6**	**12.5**			
	Chickens (1697)	N/A	**64.1**	[61.8 - 66.4]												35.9	**13.5**	**50.6**			
Aminopenicillins																					
Ampicillin	Chicken Breasts (400)	0.3	**17.0**	[13.4 - 21.0]							6.8	40.3	34.0	1.8	0.3	**0.3**	**16.8**				
	Ground Turkey (376)	0.3	**33.2**	[28.5 - 38.3]							6.4	33.2	26.9		0.3	**0.8**	**32.4**				
	Ground Beef (338)	0.9	**5.3**	[3.2 - 8.3]							8.9	46.2	37.9	0.9	0.9	**0.3**	**5.0**				
	Pork Chops (232)	0.9	**15.1**	[10.7 - 20.4]							12.9	44.4	25.0	1.7	0.9	**0.9**	**14.2**				
	Chickens (1697)	0.2	**17.6**	[15.8 - 19.5]							5.4	33.0	30.8	13.0	0.2	**0.2**	**17.3**				

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[4] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 45b. Distribution of MICs and Occurrence of Resistance among *E. coli* Isolates from Retail Meats and Chickens, 2004

Antimicrobial	Isolate Source (# of Isolates)	%I[1]	%R[2]	[95% CI][3]	Distribution (%) of MICs (µg/ml)[4] 0.015	0.03	0.06	0.125	0.25	0.5	1	2	4	8	16	32	64	128	256	512	1024
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Chicken Breasts (400)	0.5	**10.0**	[7.2 - 13.4]							1.8	21.8	51.3	14.8	0.5	**7.3**	**2.8**				
	Ground Turkey (376)	3.5	**5.3**	[3.3 - 8.1]							1.3	19.9	41.8	28.2	3.5	**4.5**	**0.8**				
	Ground Beef (338)	0.3	**3.8**	[2.1 - 6.5]							4.4	23.4	60.9	7.1	0.3	**3.6**	**0.3**				
	Pork Chops (232)	0.4	**5.6**	[3.0 - 9.4]							4.3	27.6	46.6	15.5	0.4	**4.7**	**0.9**				
	Chickens (1697)	1.8	**8.8**	[7.5 - 10.2]							1.9	26.3	47.9	13.3	1.8	**5.5**	**3.2**				
Cephalosporins																					
Ceftiofur	Chicken Breasts (400)	1.0	**5.8**	[3.7 - 8.5]				4.8	50.5	35.3	2.8		1.0	**4.3**	**1.5**						
	Ground Turkey (376)	0.3	**1.1**	[0.3 - 2.7]				1.9	47.9	45.2	2.4	1.3	0.3	**0.5**	**0.5**						
	Ground Beef (338)	0.6	**0.9**	[0.2 - 2.6]				5.0	49.4	41.7	2.1	0.3	0.6		**0.9**						
	Pork Chops (232)	0.0	**0.4**	[0.0 - 2.4]				7.3	51.7	39.7	0.9			**0.4**							
	Chickens (1697)	2.0	**4.9**	[3.9 - 6.0]				7.1	61.6	22.2	1.8	0.4	2.0	**3.3**	**1.6**						
Ceftriaxone	Chicken Breasts (400)	3.0	**0.0**	[0.0 - 0.9]					90.0	1.3	2.0	0.3		3.5	2.0	1.0					
	Ground Turkey (376)	0.5	**0.0**	[0.0 - 1.0]					95.5	1.3	1.9			0.8	0.3	0.3					
	Ground Beef (338)	1.2	**0.0**	[0.0 - 1.1]					95.9	1.8	0.6	0.3		0.3	0.6	0.6					
	Pork Chops (232)	0.4	**0.0**	[0.0 - 1.6]					97.0	1.7	0.9				0.4						
	Chickens (1697)	3.7	**0.1**	[0.0 - 0.3]					90.9	0.4	1.2	0.3	0.5	2.9	3.2	0.5	**0.1**				
Cephamycins																					
Cefoxitin	Chicken Breasts (400)	2.3	**8.3**	[5.7 - 11.4]							0.3	15.5	53.0	20.8	2.3	**3.8**	**4.5**				
	Ground Turkey (376)	0.8	**4.5**	[2.7 - 7.1]							0.8	22.1	55.9	16.0	0.8	**2.7**	**1.9**				
	Ground Beef (338)	1.8	**1.2**	[0.3 - 3.0]							4.1	30.2	53.8	8.9	1.8	**0.3**	**0.9**				
	Pork Chops (232)	0.4	**2.2**	[0.7 - 5.0]						0.9	2.6	26.7	59.9	7.3	0.4	**1.3**	**0.9**				
	Chickens (1697)	2.5	**8.2**	[6.9 - 9.6]						0.1	0.5	16.4	56.3	16.0	2.5	**4.5**	**3.7**				
Folate Pathway Inhibitors																					
Sulfisoxazole	Chicken Breasts (400)	N/A	**41.3**	[36.4 - 46.2]											48.5	6.3	4.0				**41.3**
	Ground Turkey (376)	N/A	**48.4**	[43.2 - 53.6]											44.4	3.2	4.0				**48.4**
	Ground Beef (338)	N/A	**13.0**	[9.6 - 17.1]											84.6		2.4				**13.0**
	Pork Chops (232)	N/A	**19.4**	[14.5 - 25.1]											69.8	3.0	6.9	0.4	0.4		**19.4**
	Chickens (1697)	N/A	**53.2**	[50.8 - 55.6]											44.5	1.9	0.1	0.1	0.2		**53.2**

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[4] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Table 45c. Distribution of MICs and Occurrence of Resistance among *E. coli* Isolates from Retail Meats and Chickens, 2004

Antimicrobial	Isolate Source (# of Isolates)	%I[1]	%R[2]	[95% CI][3]	Distribution (%) of MICs (µg/ml)[4] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Folate Pathway Inhibitors																					
Trimethoprim-Sulfamethoxazole	Chicken Breasts (400)	N/A	**4.3**	[2.5 - 6.7]				85.5	7.0	2.5	0.5	0.3		**4.3**							
	Ground Turkey (376)	N/A	**3.7**	[2.1 - 6.2]				83.8	9.3	2.7	0.5			**3.7**							
	Ground Beef (338)	N/A	**0.6**	[0.1 - 2.1]				97.0	2.1		0.3			**0.6**							
	Pork Chops (232)	N/A	**3.9**	[1.8 - 7.2]				93.1	2.2	0.9				**3.9**							
	Chickens (1697)	N/A	**10.7**	[9.2 - 12.2]				45.6	28.5	9.3	3.9	2.1	**0.5**	**10.1**							
Phenicols																					
Chloramphenicol	Chicken Breasts (400)	2.5	**1.8**	[0.7 - 3.6]								3.3	34.5	58.0	2.5	**0.3**	**1.5**				
	Ground Turkey (376)	0.8	**0.8**	[0.2 - 2.3]								1.3	36.7	60.4	0.8		**0.8**				
	Ground Beef (338)	0.9	**3.6**	[1.8 - 6.1]								0.3	26.9	68.3	0.9	**0.3**	**3.3**				
	Pork Chops (232)	0.9	**4.3**	[2.1 - 7.8]								0.9	34.1	59.9	0.9	**1.3**	**3.0**				
	Chickens (1697)	0.5	**1.0**	[0.6 - 1.6]								6.2	65.8	26.5	0.5		**1.0**				
Quinolones																					
Ciprofloxacin	Chicken Breasts (400)	0.0	**0.0**	[0.0 - 0.9]	90.3	2.3	0.5	1.8	4.0	1.3											
	Ground Turkey (376)	0.0	**0.8**	[0.2 - 2.3]	84.3	3.5	0.8	2.9	7.4	0.3				**0.8**							
	Ground Beef (338)	0.0	**0.0**	[0.0 - 1.1]	94.4	3.8		0.6	0.9	0.3											
	Pork Chops (232)	0.0	**0.0**	[0.0 - 1.6]	97.8	0.9	0.4	0.4	0.4												
	Chickens (1697)	0.0	**0.2**	[0.0 - 0.5]	92.4	0.9	0.4	3.8	2.2	0.1			**0.1**	**0.1**							
Nalidixic Acid	Chicken Breasts (400)	N/A	**7.0**	[4.7 - 10.0]							6.5	63.0	23.3	0.3		**0.3**	**6.8**				
	Ground Turkey (376)	N/A	**10.6**	[7.7 - 14.2]							3.7	62.0	21.5	1.6	0.5	**0.5**	**10.1**				
	Ground Beef (338)	N/A	**1.5**	[0.5 - 3.4]							3.0	67.5	26.9	1.2		**0.9**	**0.6**				
	Pork Chops (232)	N/A	**0.0**	[0.0 - 1.6]							9.9	68.5	19.4	1.3	0.9						
	Chickens (1697)	N/A	**6.8**	[5.6 - 8.1]						0.2	16.0	64.6	12.0	0.4	0.1	**0.8**	**6.0**				
Tetracyclines																					
Tetracycline	Chicken Breasts (400)	0.8	**48.0**	[43.0 - 53.0]									51.3	0.8	**0.5**	**3.3**	**44.3**				
	Ground Turkey (376)	0.5	**74.2**	[69.5 - 78.6]									25.3	0.5		**6.9**	**67.3**				
	Ground Beef (338)	6.5	**22.8**	[18.4 - 27.6]									70.7	6.5	**2.7**	**1.2**	**18.9**				
	Pork Chops (232)	2.2	**56.0**	[49.4 - 62.5]									41.8	2.2		**6.0**	**50.0**				
	Chickens (1697)	1.1	**50.3**	[47.9 - 52.7]									48.6	1.1	**1.6**	**15.4**	**33.2**				

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) calculated using the Clopper-Pearson exact method

[4] The unshaded areas indicate the dilution range of the Sensititre plates used to test 2004 isolates. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest concentrations on the Sensititre plate. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration

Resistance by Year

Table 46a. Antimicrobial Resistance among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2004

Year			2000	2001	2002	2003	2004
Number of Isolates Tested		Chicken Breasts			282	396	400
		Ground Turkey			304	333	376
		Ground Beef			295	311	338
		Pork Chops			184	218	232
		Chickens	285	1989	2100	1365	1697
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**					
Aminoglycosides	Amikacin (MIC ≥ 64 µg/ml)	Chicken Breasts			0.0% 0	0.0% 0	0.0% 0
		Ground Turkey			0.0% 0	0.0% 0	0.0% 0
		Ground Beef			0.0% 0	0.0% 0	0.0% 0
		Pork Chops			0.0% 0	0.0% 0	0.0% 0
		Chickens	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Gentamicin (MIC ≥ 16 µg/ml)	Chicken Breasts			23.0% 65	29.3% 116	30.0% 120
		Ground Turkey			27.0% 82	29.7% 99	29.3% 110
		Ground Beef			0.3% 1	1.0% 3	0.6% 2
		Pork Chops			1.1% 2	1.4% 3	1.3% 3
		Chickens	40.0% 114	33.4% 664	38.0% 799	38.8% 530	39.1% 663
	Kanamycin (MIC ≥ 64 µg/ml)	Chicken Breasts			6.0% 17	6.8% 27	6.8% 27
		Ground Turkey			13.2% 40	16.8% 56	16.0% 60
		Ground Beef			2.4% 7	2.9% 9	2.4% 8
		Pork Chops			5.4% 10	8.7% 19	8.2% 19
		Chickens	16.1% 46	14.5% 288	11.6% 243	10.3% 140	11.5% 196
	Streptomycin (MIC ≥ 64 µg/ml)	Chicken Breasts			49.3% 139	56.1% 222	56.8% 227
		Ground Turkey			57.6% 175	54.7% 182	49.2% 185
		Ground Beef			9.5% 28	9.0% 28	11.8% 40
		Pork Chops			22.3% 41	19.7% 43	21.1% 49
		Chickens	77.5% 221	65.8% 1308	65.1% 1368	64.2% 877	64.1% 1088
Aminopenicillins	Ampicillin (MIC ≥ 32 µg/ml)	Chicken Breasts			21.6% 61	25.3% 100	17.0% 68
		Ground Turkey			31.3% 95	35.7% 119	33.2% 125
		Ground Beef			6.1% 18	5.1% 16	5.3% 18
		Pork Chops			13.6% 25	13.3% 29	15.1% 35
		Chickens	20.0% 57	19.5% 388	19.0% 399	18.6% 254	17.6% 298
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Chicken Breasts			12.1% 34	13.6% 54	10.0% 40
		Ground Turkey			5.6% 17	3.0% 10	5.3% 20
		Ground Beef			2.0% 6	2.3% 7	3.8% 13
		Pork Chops			5.4% 10	5.0% 11	5.6% 13
		Chickens	8.1% 23	10.0% 199	10.9% 229	11.1% 151	8.8% 149

Table 46b. Antimicrobial Resistance among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2004

Year			2000	2001	2002	2003	2004
Number of Isolates Tested		Chicken Breasts			282	396	400
		Ground Turkey			304	333	376
		Ground Beef			295	311	338
		Pork Chops			184	218	232
		Chickens	285	1989	2100	1365	1697
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**					
Cephalosporins	Ceftiofur (MIC ≥ 8 µg/ml)	Chicken Breasts			7.1% 20	7.6% 30	5.8% 23
		Ground Turkey			1.0% 3	0.3% 1	1.1% 4
		Ground Beef			0.0% 0	0.3% 1	0.9% 3
		Pork Chops			0.5% 1	0.9% 2	0.4% 1
		Chickens	6.3% 18	4.4% 88	5.5% 115	7.1% 97	4.9% 83
	Ceftriaxone (MIC ≥ 64 µg/ml)	Chicken Breasts			0.0% 0	0.0% 0	0.0% 0
		Ground Turkey			0.0% 0	0.0% 0	0.0% 0
		Ground Beef			0.0% 0	0.0% 0	0.0% 0
		Pork Chops			0.0% 0	0.0% 0	0.0% 0
		Chickens	0.0% 0	0.0% 0	0.0% 1	0.0% 0	0.1% 1
Cephalosporins	Cephalothin (MIC ≥ 32 µg/ml)	Chicken Breasts			21.3% 60	22.0% 87	
		Ground Turkey			14.8% 45	18.9% 63	
		Ground Beef			5.8% 17	8.0% 25	
		Pork Chops			10.3% 19	11.9% 26	
		Chickens	17.9% 51	12.9% 256	15.1% 317	16.6% 226	
Cephamycins	Cefoxitin (MIC ≥ 32 µg/ml)	Chicken Breasts			11.0% 31	9.3% 37	8.3% 33
		Ground Turkey			3.3% 10	1.2% 4	4.5% 17
		Ground Beef			1.4% 4	0.3% 1	1.2% 4
		Pork Chops			3.3% 6	2.3% 5	2.2% 5
		Chickens	7.4% 21	8.7% 173	8.5% 178	8.3% 113	8.2% 139
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole[1] (MIC ≥ 512 µg/ml)	Chicken Breasts			32.3% 91	38.4% 152	41.3% 165
		Ground Turkey			48.0% 146	51.7% 172	48.4% 182
		Ground Beef			9.8% 29	10.3% 32	13.0% 44
		Pork Chops			12.5% 23	15.1% 33	19.4% 45
		Chickens	57.9% 165	58.2% 1157	46.1% 969	43.9% 599	53.2% 903
	Trimethoprim-Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Chicken Breasts			3.5% 10	7.1% 28	4.3% 17
		Ground Turkey			3.9% 12	6.9% 23	3.7% 14
		Ground Beef			0.7% 2	0.3% 1	0.6% 2
		Pork Chops			1.1% 2	2.8% 6	3.9% 9
		Chickens	17.2% 49	12.6% 251	10.4% 218	10.5% 144	10.7% 181

[1] Sulfamethoxazole was tested from 1996 through 2003 and was replaced by sulfisoxazole in 2004

Table 46c. Antimicrobial Resistance among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2004

Year			2000	2001	2002	2003	2004
Number of Isolates Tested		Chicken Breasts			282	396	400
		Ground Turkey			304	333	376
		Ground Beef			295	311	338
		Pork Chops			184	218	232
		Chickens	285	1989	2100	1365	1697
Antimicrobial Class	**Antimicrobial (Resistance Breakpoint)**	**Isolate Source**					
Phenicols	Chloramphenicol (MIC ≥ 32 µg/ml)	Chicken Breasts			0.7% 2	0.0% 0	1.8% 7
		Ground Turkey			0.3% 1	3.6% 12	0.8% 3
		Ground Beef			1.0% 3	2.3% 7	3.6% 12
		Pork Chops			1.6% 3	4.1% 9	4.3% 10
		Chickens	4.6% 13	2.4% 47	1.8% 38	1.3% 18	1.0% 17
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Chicken Breasts			0.0% 0	0.0% 0	0.0% 0
		Ground Turkey			0.0% 0	0.3% 1	0.8% 3
		Ground Beef			0.0% 0	0.0% 0	0.0% 0
		Pork Chops			0.0% 0	0.0% 0	0.0% 0
		Chickens	0.0% 0	0.2% 3	0.0% 1	0.1% 1	0.2% 3
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Chicken Breasts			2.8% 8	4.0% 16	7.0% 28
		Ground Turkey			4.3% 13	11.7% 39	10.6% 40
		Ground Beef			0.0% 0	1.0% 3	1.5% 5
		Pork Chops			0.5% 1	0.5% 1	0.0% 0
		Chickens	10.2% 29	8.4% 168	6.8% 142	6.2% 84	6.8% 115
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Chicken Breasts			46.1% 130	42.9% 170	48.0% 192
		Ground Turkey			77.0% 234	77.8% 259	74.2% 279
		Ground Beef			30.8% 91	25.1% 78	22.8% 77
		Pork Chops			52.7% 97	46.3% 101	56.0% 130
		Chickens	68.4% 195	61.6% 1226	58.6% 1231	52.2% 713	50.3% 853

Table 47. Resistance Patterns among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2004

Year		2000	2001	2002	2003	2004
Number of Isolates Tested	Chicken Breasts			282	396	400
	Ground Turkey			304	333	376
	Ground Beef			295	311	338
	Pork Chops			184	218	232
	Chickens	285	1989	2100	1365	1697
Resistance Pattern	**Isolate Source**					
1. No Resistance Detected	Chicken Breasts			27.0% 76	20.5% 81	20.8% 83
	Ground Turkey			16.8% 51	14.7% 49	19.1% 72
	Ground Beef			63.1% 186	66.9% 208	73.1% 247
	Pork Chops			41.3% 76	44.5% 97	37.9% 88
	Chickens	9.8% 28	12.6% 251	15.1% 317	15.6% 213	17.0% 288
2. At Least ACSSuT[1] Resistant	Chicken Breasts			0.4% 1	0.0% 0	1.3% 5
	Ground Turkey			0.0% 0	2.7% 9	0.5% 2
	Ground Beef			0.3% 1	1.0% 3	1.5% 5
	Pork Chops			0.5% 1	1.4% 3	1.3% 3
	Chickens	3.5% 10	2.0% 40	1.3% 27	1.0% 14	0.8% 14
3. At Least ACT/S[2] Resistant	Chicken Breasts			0.0% 0	0.0% 0	0.3% 1
	Ground Turkey			0.0% 0	0.9% 3	0.0% 0
	Ground Beef			0.0% 0	0.0% 0	0.0% 0
	Pork Chops			0.5% 1	0.0% 0	0.4% 1
	Chickens	1.4% 4	0.6% 11	0.3% 7	0.2% 3	0.3% 5
4. At Least ACSSuTAuCf[3] Resistant	Chicken Breasts			0.4% 1	0.0% 0	1.0% 4
	Ground Turkey			0.0% 0	0.3% 1	0.0% 0
	Ground Beef			0.0% 0	0.0% 0	0.9% 3
	Pork Chops			0.0% 0	0.5% 1	0.4% 1
	Chickens	2.8% 8	1.1% 22	0.8% 17	0.8% 11	0.6% 10
5. At Least Ceftiofur and Nalidixic Acid Resistant	Chicken Breasts			0.4% 1	0.5% 2	0.8% 3
	Ground Turkey			0.3% 1	0.3% 1	0.3% 1
	Ground Beef			0.0% 0	0.0% 0	0.0% 0
	Pork Chops			0.5% 1	0.0% 0	0.0% 0
	Chickens	1.4% 4	0.3% 5	0.4% 9	0.9% 12	0.4% 7

[1] ACSSuT = ampicillin, chloramphenicol, streptomycin, sulfamethoxazole/sulfisoxazole, and tetracycline

[2] ACT/S = ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole

[3] ACSSuTAuCf = ACSSuT, amoxicillin-clavulanic acid, and ceftiofur

Appendix

Table A1. Concentration Ranges Used for Susceptibility Testing of *Salmonella* and *E. coli* , 2004

Antimicrobial Class	Antimicrobial Agent	Concentration Range (µg/ml)
Aminoglycosides	Amikacin	0.5 - 64
	Gentamicin	0.25 - 16
	Kanamycin	8 - 64
	Streptomycin	32 - 64
Aminopenicillins	Ampicillin	1 - 32
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin–Clavulanic Acid	1 / 0.5 - 32 / 16
Cephalosporins	Ceftiofur	0.12 - 8
	Ceftriaxone	0.25 - 64
Cephamycins	Cefoxitin	0.5 - 32
Folate Pathway Inhibitors	Sulfisoxazole	16 - 256
	Trimethoprim–Sulfamethoxazole	0.12 / 2.4 - 4 / 76
Phenicols	Chloramphenicol	2 - 32
Quinolones	Ciprofloxacin	0.015 - 4
	Nalidixic acid	0.5 - 32
Tetracyclines	Tetracycline	4 - 32

Table A2. Concentration Ranges Used for Susceptibility Testing[1] of *Campylobacter*, 2004

Antimicrobial Class	Antimicrobial Agent	Concentration Range (µg/ml)	
		Etest®	Broth Microdilution
Aminoglycosides	Gentamicin	0.016 - 256	0.12 - 32
Ketolides	Telithromycin	N/A	0.015 - 8
Lincosamides	Clindamycin	0.016 - 256	0.03 - 16
Macrolides	Azithromycin	0.016 - 256	0.015 - 64
	Erythromycin	0.016 - 256	0.03 - 64
Phenicols	Chloramphenicol	0.016 - 256	N/A
	Florfenicol	N/A	0.03 - 64
Quinolones	Ciprofloxacin	0.002 - 32	0.015 - 64
	Nalidixic acid	0.016 - 256	4 - 64
Tetracyclines	Tetracycline	0.016 - 256	0.06 - 64

[1] Etest® was used to test human and food animal isolates while a broth microdilution method was used to test retail meat isolates