



U.S. Food and Drug Administration

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2008

Executive Report



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I. Introduction

A. Executive Report

This report summarizes, in an integrated format, National Antimicrobial Resistance Monitoring System data on *Salmonella* (non-typhoidal) and *Campylobacter* recovered in 2008 from food animals at federally inspected slaughter and processing plants, retail meats, and human clinical cases. In addition, the report includes susceptibility data for *Escherichia coli* recovered from retail meats and chicken carcasses in 2008. Summary data from prior years are also included.

Suggested Citation: FDA. National Antimicrobial Resistance Monitoring System – Enteric Bacteria (NARMS): 2008 Executive Report. Rockville, MD: U.S. Department of Health and Human Services, Food and Drug Administration, 2011.

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 among 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 monitors antimicrobial susceptibility among enteric bacteria from humans, retail meats, and food animals. Monitoring is conducted for several enteric pathogens, including *Salmonella*, *Campylobacter*, and *Shigella* (humans only). Generic *Escherichia coli* (*E. coli*) and *Enterococcus* are also tested in NARMS due to their ubiquitous presence in animals, foods, and humans and their potential to serve as reservoirs of antimicrobial resistance genes for bacterial pathogens.

In addition to monitoring antimicrobial susceptibility, NARMS conducts epidemiologic and microbiologic research studies. Some studies examine risk factors and clinical outcomes of infections with specific bacterial serotypes or subsets of bacteria that exhibit particular resistance patterns. Other studies focus on understanding the genetic mechanisms of antimicrobial resistance in enteric bacteria and the mechanisms that permit the transfer of resistance between bacteria, on improving methods for isolation and typing, and on developing new methods for antimicrobial susceptibility testing. Additionally, NARMS examines *Salmonella* and *Campylobacter* strains for genetic relatedness using pulsed-field gel electrophoresis (PFGE). PFGE patterns are entered into CDC's PulseNet database or USDA's VetNet database. PulseNet and VetNet are national molecular subtyping networks for foodborne and zoonotic disease surveillance.

The following are the primary objectives of NARMS:

- To monitor trends in antimicrobial resistance among enteric bacteria from humans, retail meats, and animals
- To disseminate timely information on antimicrobial resistance to promote interventions that reduce resistance among foodborne bacteria
- To conduct research to better understand the emergence, persistence, and spread of antimicrobial resistance
- To provide data that assist the FDA in making decisions related to the approval of safe and effective antimicrobial drugs for animals

C. NARMS Components

The NARMS program has three components 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). Initially, it included non-Typhi *Salmonella* and *Escherichia coli* O157 isolates from 14 state and local health departments. Surveillance later expanded to include additional bacteria and testing sites. In 1999, testing of *Salmonella* Typhi and *Shigella* was added. By 2003, NARMS conducted nationwide surveillance for *Salmonella*, *Shigella*, and *E. coli* O157 from humans. Testing of *Campylobacter* from humans began in five FoodNet sites in 1997 and expanded to all 10 FoodNet sites by 2003. Antimicrobial susceptibility testing of NARMS human isolates was performed at CDC's laboratories in the National Center for Emerging and Zoonotic Infectious Diseases in Atlanta, Georgia.

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 was conducted through an ongoing collaboration among FDA's Center for Veterinary Medicine (CVM), CDC, and state departments of public health.¹ Participating sites purchased chicken breasts, ground turkey, ground beef, and pork chops at retail stores and cultured them for *Salmonella* and *Campylobacter*. Three or four sites also cultured retail meats for *E. coli* and *Enterococcus*.² Isolates were sent to CVM's Office of Research in Laurel, Maryland for species and serotype confirmation, antimicrobial susceptibility testing, and genetic analysis.

3. Animal Component

The animal component of NARMS began in 1997 with monitoring of *Salmonella*, and later expanded to include *Campylobacter* (1998), *E. coli* (2000), and *Enterococcus* (2003) isolated from chicken carcasses. This report includes data for *Campylobacter* and *E. coli* from chicken carcass rinsates and data for *Salmonella* from carcass rinsates (chicken), carcass swabs (turkey, cattle and swine), and ground products (chicken, turkey, and beef). Isolates were recovered from samples obtained at federally inspected slaughter and processing plants. Antimicrobial susceptibility testing for the animal component of NARMS was conducted at the USDA's Agricultural Research Service (ARS) Bacterial Epidemiology and Antimicrobial Resistance Research Unit at the Russell Research Center in Athens, Georgia.

D. Links to Additional Information

Additional information about NARMS, including comprehensive annual reports for each NARMS component, can be found on the FDA, CDC, and USDA websites listed below. The FDA website also includes NARMS Executive Reports.

¹ Most of the sites were participating FoodNet laboratories. In 2008, the Pennsylvania Department of Health joined the NARMS retail meat surveillance program, testing for *Salmonella* only.

² From 2002 through 2006, four sites cultured retail meats for *E. coli* and *Enterococcus* and in 2007 and 2008, three sites cultured retail meats for *E. coli* and *Enterococcus*.

FDA: <http://www.fda.gov/AnimalVeterinary/SafetyHealth/AntimicrobialResistance/NationalAntimicrobialResistanceMonitoringSystem/default.htm>

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

USDA: <http://ars.usda.gov/saa/bear/narms>

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 public health surveillance systems. Because NARMS isolates originate from three distinct sources, sampling strategies differ among the three components of NARMS. Sampling methods for each component 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-typhoidal *Salmonella* began in 1996 with isolates from 14 sites, and by 2003, expanded to include state and local health departments in all 50 states. Participating public health laboratories serotyped the isolates before shipment to CDC for susceptibility testing. From 1996 through 2002, participating sites submitted every tenth non-typhoidal *Salmonella* isolate they received to CDC for antimicrobial susceptibility testing. Beginning in 2003, they submitted every 20th isolate.

NARMS *Campylobacter* surveillance began in 1997 with five FoodNet sites and expanded to 10 sites (the states of Connecticut, Georgia, Maryland, Minnesota, New Mexico, Oregon, and Tennessee, and selected counties in California, Colorado, and New York) by 2003. From 1997 to 2004, the first *Campylobacter* isolated per week was submitted from each site to CDC. From 2005 through 2008, FoodNet sites submitted all *Campylobacter* isolates (Georgia, Maryland, New Mexico, Oregon, Tennessee), every other isolate (California, Colorado, Connecticut, New York), or every fifth isolate (Minnesota) to NARMS.

2. Retail Meat Component

Retail meat sampling began in January 2002 with FoodNet laboratories in Connecticut, Georgia, Maryland, Minnesota, and Tennessee; Oregon joined in September. FoodNet laboratories in California and New York joined in 2003, and FoodNet laboratories in Colorado and New Mexico joined in 2004. Each month, participating FoodNet sites purchased approximately 40 meat samples, comprising 10 samples each of chicken breasts, ground turkey, ground beef, and pork chops. From 2004 through 2007, all sites (with the exception of Maryland in 2007) cultured all meats for *Salmonella* and *Campylobacter*. In 2008, Pennsylvania joined the NARMS retail meat surveillance program; this participating site tested the same sample sources for *Salmonella* only. Also, in 2008, states tested for *Campylobacter* in retail poultry only. From 2004 through 2006, four sites (Georgia, Maryland, Oregon, and Tennessee) cultured meats for *E. coli* and *Enterococcus*, but during 2007 and 2008 only Georgia, Oregon, and Tennessee, tested for these organisms. Isolates were sent to CVM for species/serotype confirmation and antimicrobial susceptibility testing.

3. Animal Component

The animal component of NARMS began with surveillance of *Salmonella* isolates in 1997 after pilot studies were conducted in 1995 and 1996. The *Salmonella* isolates included in this report were recovered by USDA's Food Safety Inspection Service (FSIS) from carcass rinsates (chicken), carcass swabs (turkey, cattle, and swine), and ground products (chicken, turkey, and beef) collected by FSIS from federally inspected slaughter and processing plants throughout the United States as part of the Pathogen Reduction/Hazard Analysis and Critical Control Point (PR/HACCP) *Salmonella* verification testing program. ARS conducted susceptibility testing and the National Veterinary Services Laboratories (NVSL) serotyped the isolates.

Sampling methods used by FSIS for the PR/HACCP *Salmonella* verification testing program have changed since NARMS animal testing began. Before June of 2006, there were two phases of the FSIS regulatory program for *Salmonella* in raw products: non-targeted and targeted testing. Non-targeted or "A" set samples were collected at establishments randomly selected from the population of eligible

establishments, with a goal of scheduling every eligible establishment at least once a year. Other sample sets (e.g., "B", "C", and "D") were collected from establishments targeted for follow-up testing after HACCP compliance standards were not met. All sets were included in NARMS testing, but most isolates were from "A" set samples. Beginning in June of 2006, establishment testing was scheduled using risk-based criteria designed to focus FSIS resources on establishments with the most samples positive for *Salmonella* and the greatest number of samples with serotypes most frequently associated with human salmonellosis.¹

In 1998, *Campylobacter* isolates from chickens were submitted to ARS from the Eastern FSIS laboratory, and in 1999 and 2000, *Campylobacter* 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.² Nalidixic acid susceptibility and cephalothin resistance were initially used as identification criteria for *Campylobacter jejuni/coli*, which likely resulted in an underreporting of quinolone-resistant *Campylobacter*. A new ARS method was adopted in July of 2001, after which *Campylobacter* were isolated by ARS from chicken carcass rinsates submitted by the Eastern FSIS laboratory. Each FSIS laboratory tested samples collected throughout the U.S. This Executive Report contains data on *Campylobacter* recovered from chicken carcass rinsates for the period July 2001 through December 2008, when the new ARS isolation method was used. The rinsates were collected as part of the *Salmonella* PR/HACCP verification testing program described above.

USDA began testing *E. coli* for antimicrobial susceptibility in 2000. ARS isolated *E. coli* from 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 used by NARMS have undergone several design changes. The content of the panels has changed to accommodate new antimicrobial agents, to omit those no longer available or used, or to adjust dilution ranges for quality control and monitoring purposes. For example, in 2004, cephalothin was removed and sulfamethoxazole was replaced with sulfisoxazole on the *Salmonella/E. coli* panel. Appendix B shows the antimicrobial agents and antimicrobial susceptibility testing methods used since the program began.

Antimicrobial minimal 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 2008, *Salmonella* and *E. coli* were tested using a custom panel developed for Gram-negative bacteria (Trek catalog # CMV1AGNF). The quality control organisms included *Escherichia coli* ATCC 25922, *Enterococcus faecalis* ATCC 29212, *Staphylococcus aureus* ATCC 29213, and *Pseudomonas aeruginosa* ATCC 27853, according to Clinical and Laboratory Standards Institute (CLSI) recommendations.^{3,4}

Methods used to determine 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

¹ http://www.fsis.usda.gov/Science/Serotypes_Profile_Salmonella_Isolates/index.asp

² http://www.fsis.usda.gov/Science/Microbiological_Lab_Guidebook/index.asp

³ 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.

⁴ CLSI. 2008. Performance Standards for Antimicrobial Susceptibility Testing; Eighteenth Informational Supplement. CLSI document M100-S18. CLSI, Wayne, PA.

dilution for interpretation.¹ The retail component of NARMS used the agar dilution method in 2002 and 2003. The antimicrobial agents tested using agar dilution included ciprofloxacin, doxycycline, erythromycin, gentamicin, and meropenem. Recognizing the need for a standardized semi-automated method, CVM developed a broth microdilution method which was approved and published by CLSI in 2006.² The retail component began using this method in 2004 and the human and food animal components adopted the method in 2005. Testing was done using the Sensititre® semiautomated antimicrobial susceptibility system (Trek Diagnostic Systems, Westlake, Ohio) and a custom panel developed for *Campylobacter* (Trek catalog # CAMPY). The antimicrobial agents included in 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 and were adopted from CLSI documents M45-A, M100-S20, and M31-A3.^{2,3,4} For *Salmonella* and *E. coli*, CLSI breakpoints were available for all antimicrobial agents tested except streptomycin.^{3,4} For *Campylobacter*, CLSI breakpoints were available only for ciprofloxacin, doxycycline, erythromycin, and tetracycline.² NARMS breakpoints were used when CLSI breakpoints were not available. NARMS breakpoints were established based on the MIC distributions of NARMS isolates and the presence of known resistance genes or mutations. For the *Enterobacteriaceae*, CLSI revised the breakpoints for several cephalosporins in its M100-S20 document published in January 2010.⁴ The ceftriaxone breakpoint for resistance changed from ≥ 64 $\mu\text{g/ml}$ to ≥ 4 $\mu\text{g/ml}$. The new ceftriaxone breakpoints are applied to all years in this report.

¹ In USDA's NARMS annual reports, MIC values were not rounded up prior to interpretation.

² 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.

³ CLSI. 2010. Performance Standards for Antimicrobial Susceptibility Testing; Twentieth Informational Supplement. CLSI document M100-S20. CLSI, Wayne, PA.

⁴ CLSI. 2008. Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated from Animals; Approved Standard—Third Edition. CLSI document M31-A3. CLSI, Wayne, PA.

C. Breakpoints

Table 1. Interpretive Criteria Used for Susceptibility Testing of *Salmonella* and *E. coli* ¹

Antimicrobial Class	Antimicrobial Agent	Breakpoints (µg/ml)		
		Susceptible	Intermediate	Resistant
Aminoglycosides	Amikacin	≤ 16	32	≥ 64
	Gentamicin	≤ 4	8	≥ 16
	Kanamycin	≤ 16	32	≥ 64
	Streptomycin	≤ 32	N/A	≥ 64
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin–Clavulanic Acid	≤ 8 / 4	16 / 8	≥ 32 / 16
Cephems	Cefoxitin	≤ 8	16	≥ 32
	Ceftiofur	≤ 2	4	≥ 8
	Ceftriaxone ²	≤ 1	2	≥ 4
Folate Pathway Inhibitors	Sulfamethoxazole/Sulfisoxazole ³	≤ 256	N/A	≥ 512
	Trimethoprim–Sulfamethoxazole	≤ 2 / 38	N/A	≥ 4 / 76
Penicillins	Ampicillin	≤ 8	16	≥ 32
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 In this NARMS report, the revised ceftriaxone breakpoints from the CLSI M100-S20 document, published in January 2010, were used. In previous NARMS reports the ceftriaxone breakpoints from the CLSI M100-S19 were used.

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

Table 2. Interpretive Criteria Used for Susceptibility Testing of *Campylobacter*¹

Antimicrobial Class	Antimicrobial Agent	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

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*. Antimicrobial agents are listed in alphabetical order by CLSI designated antimicrobial classes.

Section III of the report contains data for non-typhoidal *Salmonella enterica* isolates recovered from food animals at slaughter, retail meats, and humans. The number of *Salmonella* isolates reported for humans each year is slightly lower than in reports prior to 2007 because typhoidal *Salmonella enterica* serotypes (Paratyphi A, tartrate-negative Paratyphi B, and Paratyphi C), which cause enteric fever in humans but are not associated with food animal reservoirs, have now been combined with serotype Typhi for reporting. Prior to 2007, NARMS reports combined data for all *Salmonella enterica* serotypes except for serotype Typhi. Data for typhoidal *Salmonella* can be found in the NARMS Human Isolates Final Report, 2008 published by CDC.

Antimicrobial susceptibility data are first presented for all non-typhoidal *Salmonella enterica* serotypes. Data are then presented the following top non-typhoidal *Salmonella enterica* serotypes in humans: Enteritidis, Typhimurium, Newport, Saintpaul, I 4,[5],12:i:-, and Heidelberg. During 2008, Javiana was the fourth most common non-typhoidal *Salmonella* serotype in humans. However, those data are not presented separately in this report because there were no *Salmonella* ser. Javiana isolates recovered from retail meats, and only one isolate each from cattle and swine. Saintpaul was a new addition to the list of top *Salmonella enterica* serotypes in humans in 2008. A large multi-state *Salmonella* ser. Saintpaul outbreak may have contributed to an increase in submissions of this *Salmonella* serotype in 2008. *Salmonella* serotype I 4,[5]12:i:- includes *Salmonella enterica* strains with the antigenic formulas I 4,12:i:- and I 4,5,12:i:-. Food animal data for *Salmonella enterica* serotype I 4,[5],12:i:- are not available before 2004 because NVSL, which serotyped the *Salmonella* isolates, did not report antigenic formulas for most monophasic *Salmonella enterica* serotypes at that time.

Section IV of the report contains data for *Campylobacter* recovered from humans, retail poultry, and chicken carcass rinsates. Due to low recovery of *Campylobacter* from ground beef and pork chops, states discontinued testing these meat types for *Campylobacter* in 2008. All resistance data on *Campylobacter* isolated from ground beef and pork chops have been extracted from this report and can be found in reports prior to 2008. Antimicrobial susceptibility data for *C. jejuni* and *C. coli* are presented separately. Section V of the report contains susceptibility data for *E. coli* 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 testing follows. MIC tables are presented for non-typhoidal *Salmonella*, *C. jejuni*, *C. coli*, and *E. coli*. The tables include MIC distributions, percentages of isolates displaying intermediate susceptibility and resistance, and 95% confidence intervals for the percent resistant, by source for 2008. 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 agent.² Single vertical bars indicate breakpoints for susceptibility, while double vertical bars indicate breakpoints for resistance.

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 Appendix A.

The MIC distributions are followed by tables that show the numbers and percentages of isolates that were resistant, by year, from 1997 through 2008.¹ Due to space constraints, data from year 1996 are not shown in the resistance tables. Resistance data from 1996 can be found in reports prior to 2008.^{2,3} 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. Similar tables are presented for *Salmonella* serotypes Enteritidis, Typhimurium, Newport, Saintpaul, I 4,[5],12;i:-, and Heidelberg.

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. Resistance to ceftriaxone and nalidixic acid in *Salmonella* is highlighted in several pie charts and graphs (Figures 6-17).^{4,5} In previous years, NARMS reports highlighted resistance to ceftiofur (an extended-spectrum cephalosporin used in food animals), which is usually indicative of the presence of an AmpC beta-lactamase gene (*bla*CMY), to represent resistance to third-generation cephalosporins. With the revised ceftriaxone breakpoints, ceftriaxone resistance (MIC \geq 4 μ g/ml) is now nearly identical to ceftiofur resistance. Resistance to the quinolone nalidixic acid (MIC \geq 32 μ g/ml) indicates certain chromosomal point mutations that also cause decreased susceptibility to ciprofloxacin (MIC \geq 0.125 μ g/ml), which is associated with greater risk of treatment failure.⁶

Finally, multidrug resistance data for all three genera are presented (Tables 13-29, 32, 35, 38, 41, 44, 47, 55, 59, and 64). Data for specific multidrug resistance phenotypes of public health importance are reported along with data on resistance to CLSI antimicrobial classes. New tables show the number of resistant *Salmonella* isolates by antimicrobial agent and the number of antimicrobial classes in a resistance pattern for each of the top serotypes (comprising at least 2% of isolates) from each source (Tables 13-21). For *Salmonella* and *E. coli*, resistance to multiple antimicrobial classes is limited to the eight CLSI antimicrobial classes tested in all years from 1996 through 2008 represented by 15 agents: amikacin, amoxicillin-clavulanic acid, ampicillin, cefoxitin, ceftiofur, ceftriaxone, chloramphenicol, ciprofloxacin, gentamicin, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole/ sulfisoxazole, tetracycline, and trimethoprim-sulfamethoxazole. Amikacin was not tested for all isolates from 1996, and cefoxitin was not tested prior to 2000. Multidrug resistance data for *Campylobacter* is a new addition to the 2008 report. All seven antimicrobial classes and all nine antimicrobial agents included in broth microdilution testing of *Campylobacter* isolates are represented in Tables 55 and 59.

The data contained in this report differ in a few cases from those previously reported. These differences may be due to changes in breakpoints, reporting of non-typhoidal *Salmonella* rather than non-Typhi *Salmonella*, and the dynamic nature of the data, which are updated if new information is obtained about the bacterial isolates or when specific isolates are retested. In a few cases, differences may be due to other reasons. For example, *Salmonella* variants are grouped together in this report (e.g., Typhimurium var. 5- is grouped with Typhimurium, and Anatum var. 15+ is grouped with Anatum), while USDA's annual report lists these *Salmonella* variants separately.

¹ Data on *Campylobacter* recovered from chickens is presented only for the period of July 2001 through December 2006, as described in Section IIA.

² FDA. National Antimicrobial Resistance Monitoring System – Enteric Bacteria (NARMS): 2007 Executive Report. Rockville, MD: U.S. Department of Health and Human Services, Food and Drug Administration, 2010.

³ Data from 1996 are still included in the graphs and supporting tables.

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.

⁶ Crump JA, Barrett TJ, Nelson JT, Angulo FJ. Reevaluating fluoroquinolone breakpoints for *Salmonella enterica* serotype Typhi and for Non-Typhi salmonellae. Clin Inf Dis 2003;37:75-81.

III. Non-Typhoidal *Salmonella* Data

A. Non-Typhoidal *Salmonella* Isolates Tested

Table 3. Number of Non-Typhoidal *Salmonella* Isolates Tested, by Source and Year, 1996-2008 ¹

Source	Year												
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	1318	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2379
Chicken Breasts							60	83	157	153	152	99	199
Ground Turkey							74	114	142	183	159	190	245
Ground Beef							9	10	14	8	19	13	24
Pork Chops							10	5	11	9	8	18	23
Chickens		214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624
Turkeys		107	240	713	518	550	244	262	236	227	304	271	148
Cattle		24	284	1610	1388	893	1008	670	607	329	389	439	443
Swine		111	793	876	451	418	379	211	308	301	304	211	111

¹ NARMS reports for the years 1996-2006 combined data for all non-Typhi *Salmonella* isolates from humans. Beginning in 2007, NARMS reported data separately for all typhoidal *Salmonella* serotypes (i.e. Typhi, Paratyphi A, tartrate-negative Paratyphi B, and Paratyphi C). This report includes data only for non-typhoidal isolates from humans. Data for typhoidal *Salmonella* can be found in the NARMS Human Isolates Final Reports, published by CDC

B. Isolation of Non-Typhoidal *Salmonella* from Retail Meats

Table 4. Number and Percent of Retail Meat Samples Culture Positive for *Salmonella*, 2008

	Chicken Breasts	Ground Turkey	Ground Beef	Pork Chops
Number of Meat Samples Tested	1310	1309	1310	1307
Number Positive for <i>Salmonella</i>	199	245	24	23
Percent Positive for <i>Salmonella</i>	15.2%	18.7%	1.8%	1.8%

Figure 1. Percent of Retail Meat Samples Culture Positive for *Salmonella*, 2008

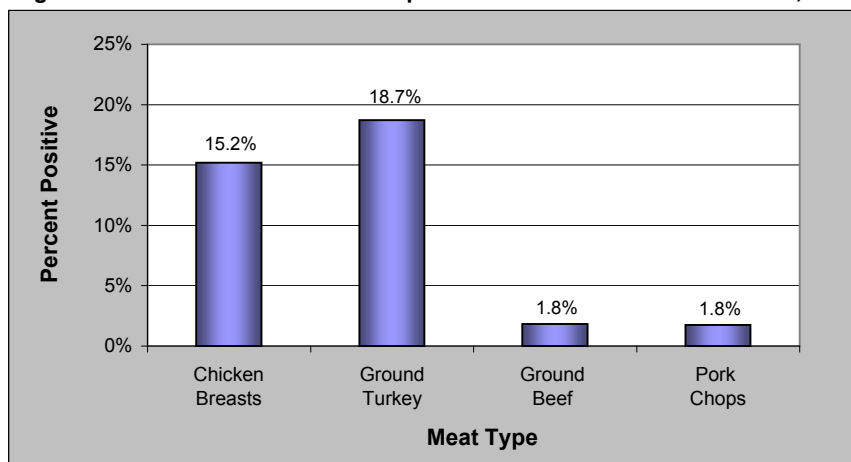
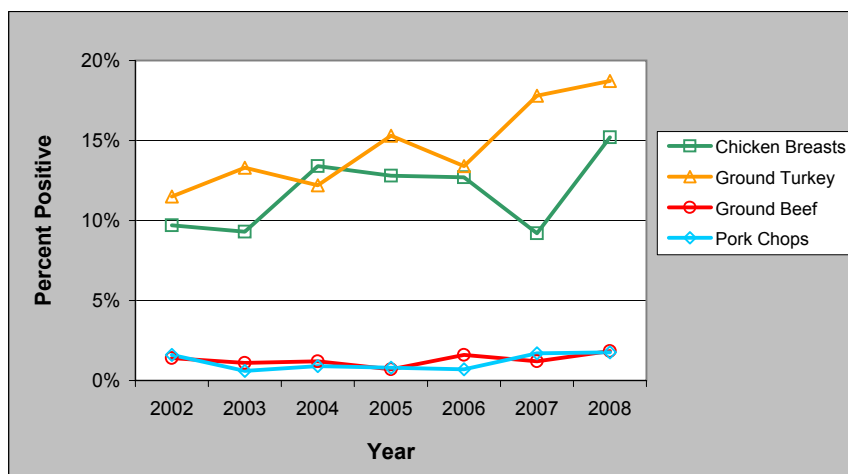


Figure 2. Percent of Retail Meat Samples Culture Positive for *Salmonella*, 2002-2008



C. Non-Typhoidal *Salmonella* Serotypes

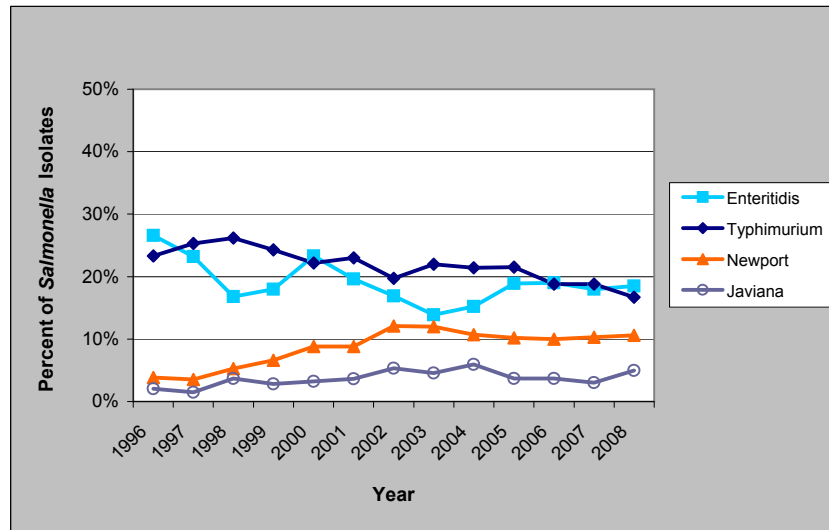
Table 5. Most Common Serotypes among Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, 2008

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (N=2379)	Enteritidis	439	18.5	Chicken Breasts (N=199)	Typhimurium	68	34.2	Chickens (N=624)	Kentucky	219	35.1
	Typhimurium	397	16.7		Enteritidis	30	15.1		Enteritidis	116	18.6
	Newport	252	10.6		Heidelberg	30	15.1		Heidelberg	94	15.1
	Javiana	118	5.0		Kentucky	30	15.1		Typhimurium	70	11.2
	Saintpaul	108	4.5		Mbandaka	7	3.5		I 4,[5],12:i:-	29	4.6
	I 4,[5],12:i:-	83	3.5		Infantis	5	2.5		Infantis	14	2.2
	Heidelberg	75	3.2		I 4,[5],12:i:-	4	2.0		Montevideo	13	2.1
	Montevideo	68	2.9		Montevideo	4	2.0		Schwarzengrund	7	1.1
	Braenderup	56	2.4		Senftenberg	4	2.0		Senftenberg	6	1.0
	Infantis	51	2.1		Braenderup	3	1.5		Other	56	9.0
	Muenchen	51	2.1		Anatum	2	1.0				
	Oranienburg	50	2.1		Bareilly	2	1.0				
	Agona	39	1.6		Hadar	2	1.0				
	Thompson	32	1.3		Other	8	4.0				
	Mississippi	31	1.3								
	Poona	26	1.1	Ground Turkey (N=245)	Hadar	70	28.6	Turkeys (N=148)	Hadar	40	27.0
	Schwarzengrund	24	1.0		Heidelberg	56	22.9		Saintpaul	16	10.8
	Litchfield	23	1.0		Saintpaul	31	12.7		III 18:z4,z23:-	14	9.5
	Paratyphi B var. L(+) tartrate+	23	1.0		IIIa 18:z4,z23:-	16	6.5		Schwarzengrund	9	6.1
	Hadar	19	0.8		Senftenberg	9	3.7		Heidelberg	8	5.4
	All other serotypes	349	14.7		Anatum	7	2.9		Newport	8	5.4
	Unknown serotype	35	1.5		Derby	6	2.4		Agona	6	4.1
	Partially serotyped	14	0.6		Schwarzengrund	6	2.4		Senftenberg	6	4.1
	Rough/Nonmotile isolates	16	0.7		Albany	5	2.0		Worthington	6	4.1
					Berta	5	2.0		Other	35	23.6
					Reading	5	2.0				
			Uganda		4	1.6					
			Agona		3	1.2					
			Newport		3	1.2					
			Norwich	3	1.2						
			Typhimurium	3	1.2						
			Other	13	5.3						
			Ground Beef (N=24)	Mbandaka	6	25.0	Cattle (N=443)	Montevideo	104	23.5	
				Newport	3	12.5		Dublin	53	12.0	
				Bareilly	2	8.3		Anatum	35	7.9	
				Montevideo	2	8.3		Newport	31	7.0	
				Norwich	2	8.3		Typhimurium	28	6.3	
				Typhimurium	2	8.3		Cerro	27	6.1	
				Brandenburg	1	4.2		Kentucky	22	5.0	
				Enteritidis	1	4.2		Muenster	18	4.1	
				Heidelberg	1	4.2		Agona	17	3.8	
				Kentucky	1	4.2		Mbandaka	17	3.8	
			Meleagridis	1	4.2	Meleagridis	17	3.8			
			Saintpaul	1	4.2	Other	74	16.7			
			Uganda	1	4.2						
			Pork Chops (N=23)	Mbandaka	6	26.1	Swine (N=111)	Derby	25	22.5	
				Adelaide	3	13.0		Infantis	15	13.5	
				Typhimurium	3	13.0		Typhimurium	10	9.0	
				Alachua	2	8.7		Agona	6	5.4	
				Bareilly	2	8.7		Anatum	6	5.4	
				Johannesburg	2	8.7		London	6	5.4	
				Derby	1	4.3		Saintpaul	6	5.4	
				Infantis	1	4.3		Johannesburg	5	4.5	
				Norwich	1	4.3		Ohio	4	3.6	
				Senftenberg	1	4.3		Hadar	3	2.7	
			Uganda	1	4.3	Other	25	22.5			

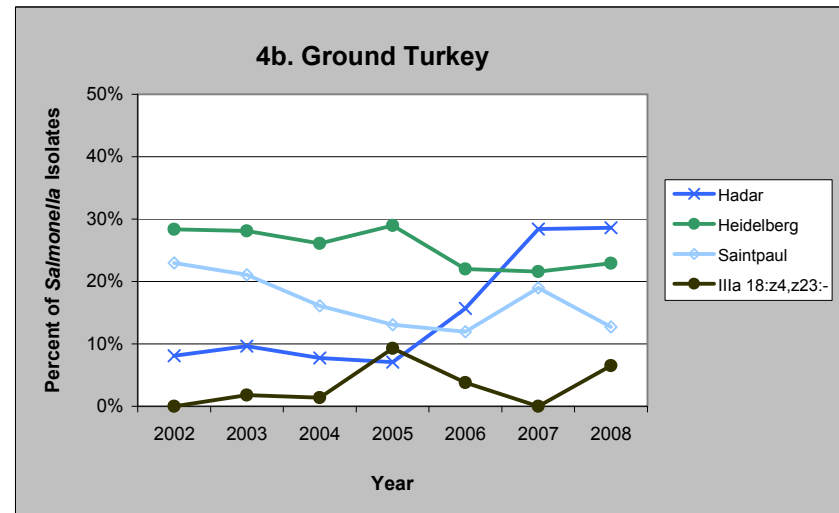
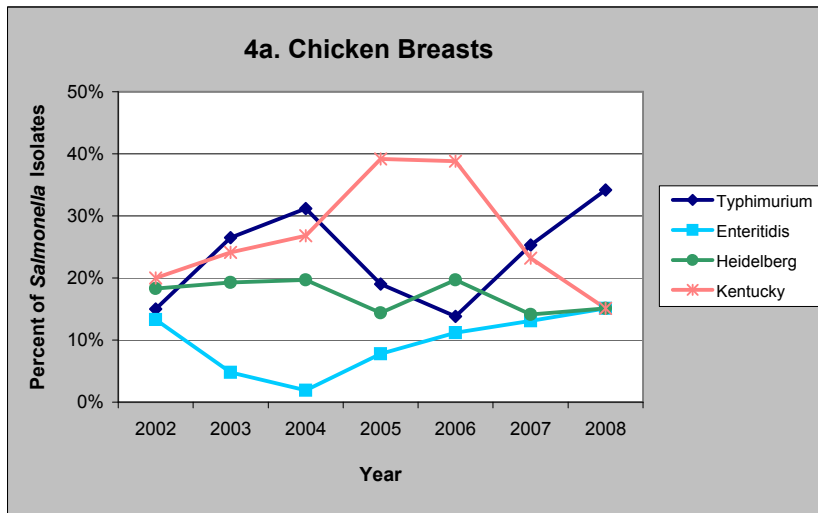
Table 6. Most Common Non-Typhoidal *Salmonella* Serotypes in Humans and their Distributions among Retail Meat and Food Animal Isolates, by Meat Type and Animal Source, 2008

	Humans	Retail Meats				Food Animals			
	Humans (N=2379)	Chicken Breast (N=199)	Ground Turkey (N=245)	Ground Beef (N=24)	Pork Chops (N=23)	Chickens (N=624)	Turkeys (N=148)	Cattle (N=443)	Swine (N=111)
1. Enteritidis	18.5% 439	15.1% 30	0.4% 1	4.2% 1	0.0% 0	18.6% 116	0.7% 1	1.1% 5	0.0% 0
2. Typhimurium	16.7% 397	34.2% 68	1.2% 3	8.3% 2	13.0% 3	11.2% 70	2.0% 3	6.3% 28	9.0% 10
3. Newport	10.6% 252	0.0% 0	1.2% 3	12.5% 3	0.0% 0	0.2% 1	5.4% 8	7.0% 31	1.8% 2
4. Javiana	5.0% 118	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.2% 1	0.9% 1
5. Saintpaul	4.5% 108	0.0% 0	12.7% 31	4.2% 1	0.0% 0	0.0% 0	10.8% 16	0.0% 0	5.4% 6
6. I 4,[5],12:i-	3.5% 83	2.0% 4	0.0% 0	0.0% 0	0.0% 0	4.6% 29	0.0% 0	0.2% 1	0.9% 1
7. Heidelberg	3.2% 75	15.1% 30	22.9% 56	4.2% 1	0.0% 0	15.1% 94	5.4% 8	0.7% 3	0.9% 1
8. Montevideo	2.9% 68	2.0% 4	0.4% 1	8.3% 2	0.0% 0	2.1% 13	0.7% 1	23.5% 104	0.9% 1
9. Braenderup	2.4% 56	1.5% 3	0.0% 0	0.0% 0	0.0% 0	0.5% 3	0.0% 0	0.7% 3	0.0% 0
10. Infantis	2.1% 51	2.5% 5	0.4% 1	0.0% 0	4.3% 1	2.2% 14	0.0% 0	0.9% 4	13.5% 15
11. Muenchen	2.1% 51	0.5% 1	0.8% 2	0.0% 0	0.0% 0	0.2% 1	2.7% 4	0.5% 2	0.9% 1

Figure 3. Most Common Non-Typhoidal *Salmonella* Serotypes from Humans in 2008 and their Relative Frequencies, by Year, 1996-2008

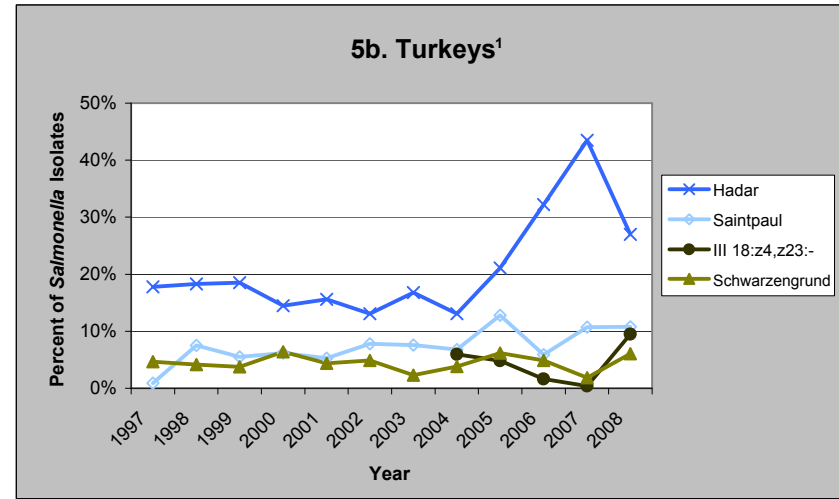
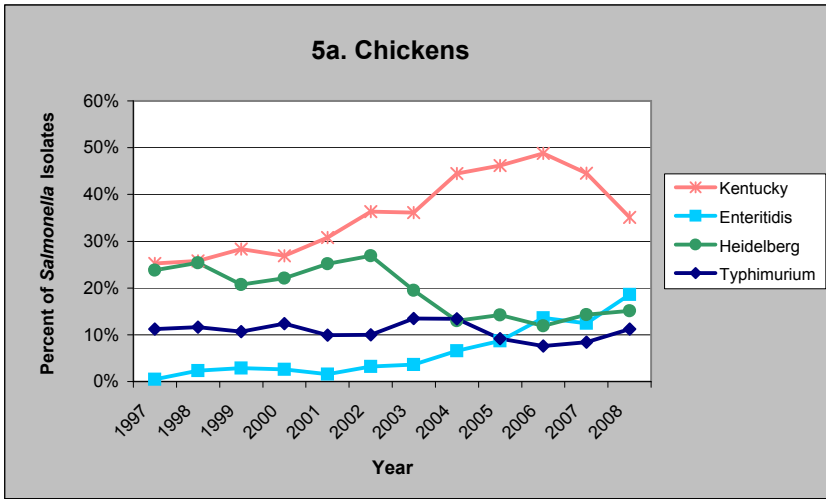


Figures 4a-b. Most Common Non-Typhoidal *Salmonella* Serotypes from Retail Poultry in 2008 and their Relative Frequencies, by Year, 2002-2008¹

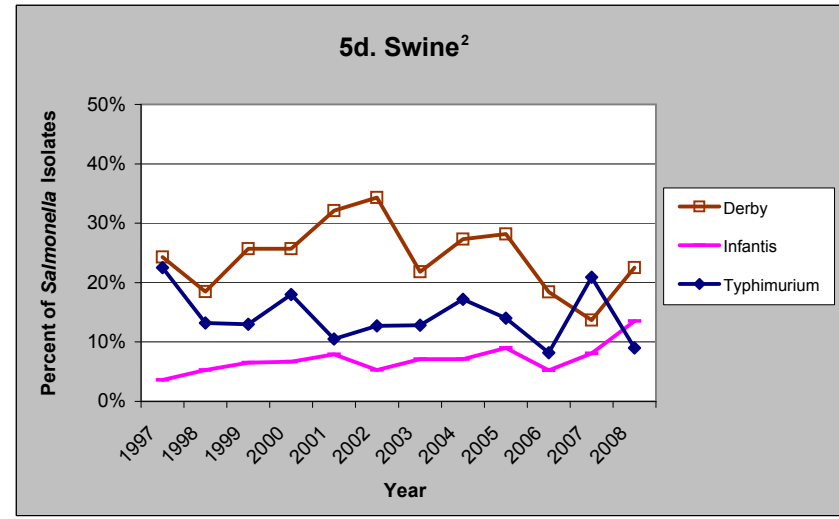
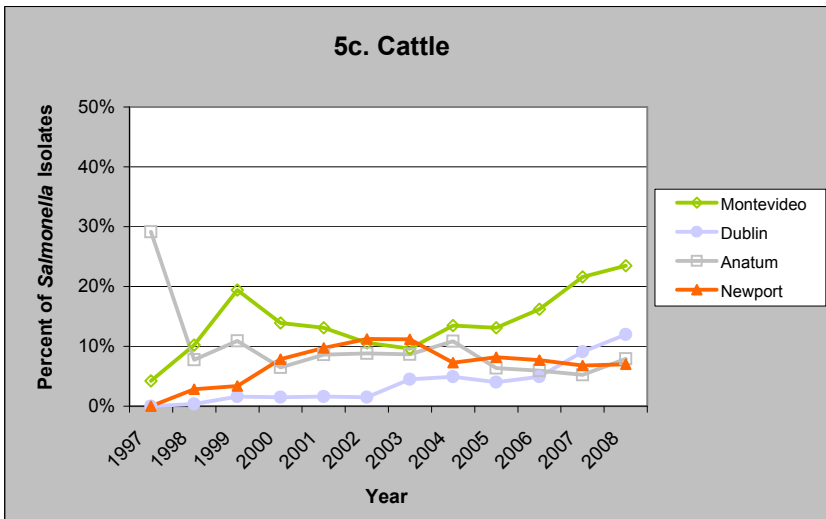


¹ Graphs are not provided for ground beef and pork chops due to the small number of *Salmonella* isolates from these sources

Figures 5a-d. Most Common Non-Typhoidal *Salmonella* Serotypes from Food Animals in 2008 and their Relative Frequencies, by Year, 1997-2008



¹ Prior to 2004, antigenic formula III 18:z4,z23:- was not separately identified or reported for food animals isolates



² There are only three serotypes shown above because the fourth highest frequency was shared by multiple serotypes. See Table 5

D. Antimicrobial Susceptibility among all Non-Typhoidal *Salmonella*

MIC Distributions

Table 7a. Distribution of MICs and Occurrence of Resistance among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, 2008

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 (2379)	0.0	0.0	[0.0 - 0.2]							3.1	48.4	45.9	2.6	<0.1						
	Chicken Breasts (199)	0.0	0.0	[0.0 - 1.8]							0.5	41.2	52.3	5.5	0.5						
	Ground Turkey (245)	0.4	0.0	[0.0 - 1.5]								11.0	74.7	12.7	1.2		0.4				
	Ground Beef (24)	0.0	0.0	[0.0 - 14.2]								8.3	79.2	12.5							
	Pork Chops (23)	0.0	0.0	[0.0 - 14.8]								8.7	82.6	8.7							
	Chickens (624)	0.0	0.0	[0.0 - 0.6]							11.7	61.7	25.2	1.4							
	Turkeys (148)	0.0	0.0	[0.0 - 2.5]							4.7	56.8	36.5	2.0							
	Cattle (443)	0.0	0.0	[0.0 - 0.8]							5.0	43.1	47.9	3.6	0.5						
	Swine (111)	0.0	0.0	[0.0 - 3.3]							4.5	55.9	37.8	1.8							
Gentamicin	Humans (2379)	0.1	1.5	[1.0 - 2.0]							33.5	61.4	3.4	0.1		0.1	0.4	1.1			
	Chicken Breasts (199)	0.0	7.0	[3.9 - 11.5]							28.6	56.3	8.0					7.0			
	Ground Turkey (245)	0.4	27.8	[22.2 - 33.8]							8.2	51.0	11.0	1.2	0.4	0.4	4.9	22.9			
	Ground Beef (24)	0.0	8.3	[1.0 - 27.0]							4.2	75.0	8.3	4.2				8.3			
	Pork Chops (23)	0.0	13.0	[2.8 - 33.6]							4.4	52.2	26.1	4.4				8.7	4.4		
	Chickens (624)	0.3	5.6	[3.9 - 7.7]							50.2	42.6	1.3			0.3		2.6	3.0		
	Turkeys (148)	1.4	16.9	[11.2 - 23.9]							33.8	43.2	4.1		0.7	1.4	6.1	10.8			
	Cattle (443)	0.5	1.6	[0.6 - 3.2]							25.5	63.2	9.0	0.2		0.5	0.7	0.9			
	Swine (111)	0.0	2.7	[0.6 - 7.7]							34.2	59.5	3.6				1.8	0.9			
Kanamycin	Humans (2379)	<0.1	2.1	[1.5 - 2.7]												97.6	0.3	<0.1	<0.1	2.0	
	Chicken Breasts (199)	0.5	10.6	[6.7 - 15.7]												86.9	2.0	0.5	0.5	10.1	
	Ground Turkey (245)	2.0	18.0	[13.4 - 23.3]												72.7	7.4	2.0	0.4	17.6	
	Ground Beef (24)	0.0	8.3	[1.0 - 27.0]												83.3	8.3			8.3	
	Pork Chops (23)	0.0	0.0	[0.0 - 14.8]												100.0					
	Chickens (624)	0.0	3.4	[2.1 - 5.1]												96.3	0.3		0.3	3.0	
	Turkeys (148)	0.0	14.2	[9.0 - 20.9]												84.5	1.4		0.7	13.5	
	Cattle (443)	0.2	9.9	[7.3 - 13.1]												89.8		0.2	0.2	9.7	
	Swine (111)	0.0	3.6	[1.0 - 9.0]												96.4				3.6	
Streptomycin	Humans (2379)	N/A	10.0	[8.8 - 11.2]													90.0		4.1	5.8	
	Chicken Breasts (199)	N/A	23.6	[17.9 - 30.1]													76.4		9.6	14.1	
	Ground Turkey (245)	N/A	58.8	[52.3 - 65.0]													41.2		25.7	33.1	
	Ground Beef (24)	N/A	20.8	[7.1 - 42.2]													79.2			20.8	
	Pork Chops (23)	N/A	13.0	[2.8 - 33.6]													87.0		8.7	4.4	
	Chickens (624)	N/A	25.2	[21.8 - 28.8]													74.8		19.9	5.3	
	Turkeys (148)	N/A	32.4	[25.0 - 40.6]													67.6		23.0	9.5	
	Cattle (443)	N/A	23.0	[19.2 - 27.2]													77.0		2.9	20.1	
	Swine (111)	N/A	29.7	[21.4 - 39.1]													70.3		6.3	23.4	

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates that were resistant

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

⁴ 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 areas 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

Table 7b. Distribution of MICs and Occurrence of Resistance among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, 2008

Antimicrobial	Isolate Source (# of Isolates)	% 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	Humans (2379)	4.1	3.0	[2.3 - 3.7]	<table border="1"> <tr> <td>87.6</td><td>2.6</td><td>0.4</td><td>2.3</td><td>4.1</td><td>0.5</td><td>2.5</td> </tr> <tr> <td>65.8</td><td>5.0</td><td></td><td>3.0</td><td>3.5</td><td>1.5</td><td>21.1</td> </tr> <tr> <td>43.7</td><td>5.7</td><td></td><td>18.4</td><td>26.9</td><td>0.8</td><td>4.5</td> </tr> <tr> <td>75.0</td><td>12.5</td><td></td><td></td><td>4.2</td><td></td><td>8.3</td> </tr> <tr> <td>82.6</td><td>4.4</td><td></td><td>13.0</td><td></td><td></td><td></td> </tr> <tr> <td>88.6</td><td>0.8</td><td>0.2</td><td>1.4</td><td>0.3</td><td>3.4</td><td>5.3</td> </tr> <tr> <td>66.9</td><td>0.7</td><td>1.4</td><td>11.5</td><td>14.2</td><td>2.0</td><td>3.4</td> </tr> <tr> <td>77.7</td><td>0.7</td><td>0.2</td><td>3.6</td><td>1.4</td><td>5.0</td><td>11.5</td> </tr> <tr> <td>82.9</td><td>1.8</td><td>0.9</td><td>5.4</td><td>4.5</td><td></td><td>4.5</td> </tr> </table>																87.6	2.6	0.4	2.3	4.1	0.5	2.5	65.8	5.0		3.0	3.5	1.5	21.1	43.7	5.7		18.4	26.9	0.8	4.5	75.0	12.5			4.2		8.3	82.6	4.4		13.0				88.6	0.8	0.2	1.4	0.3	3.4	5.3	66.9	0.7	1.4	11.5	14.2	2.0	3.4	77.7	0.7	0.2	3.6	1.4	5.0	11.5	82.9	1.8	0.9	5.4	4.5		4.5																																																																																											
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Chicken Breasts (199)	3.5	22.6	[17.0 - 29.1]																																																																																																																																																																											
Ground Turkey (245)	26.9	5.3	[2.9 - 8.9]																																																																																																																																																																											
Ground Beef (24)	4.2	8.3	[1.0 - 27.0]																																																																																																																																																																											
Pork Chops (23)	0.0	0.0	[0.0 - 14.8]																																																																																																																																																																											
Chickens (624)	0.3	8.7	[6.6 - 11.1]																																																																																																																																																																											
Turkeys (148)	14.2	5.4	[2.4 - 10.4]																																																																																																																																																																											
Cattle (443)	1.4	16.5	[13.1 - 20.3]																																																																																																																																																																											
Swine (111)	4.5	4.5	[1.5 - 10.2]																																																																																																																																																																											
Cephems Cefoxitin	Humans (2379)	0.2	2.9	[2.3 - 3.7]	<table border="1"> <tr> <td>0.3</td><td>28.8</td><td>55.4</td><td>11.3</td><td>0.9</td><td>0.2</td><td>1.0</td><td>1.9</td> </tr> <tr> <td>2.5</td><td>52.8</td><td>21.6</td><td>0.5</td><td>1.0</td><td>6.5</td><td>15.1</td> </tr> <tr> <td>0.8</td><td>65.7</td><td>24.9</td><td>4.1</td><td></td><td>0.4</td><td>4.1</td> </tr> <tr> <td>4.2</td><td>41.7</td><td>45.8</td><td></td><td></td><td>4.2</td><td>4.2</td> </tr> <tr> <td></td><td>39.1</td><td>60.9</td><td></td><td></td><td></td><td></td> </tr> <tr> <td>19.9</td><td>58.0</td><td>13.0</td><td>0.5</td><td>0.6</td><td>6.4</td><td>1.6</td> </tr> <tr> <td>8.1</td><td>61.5</td><td>24.3</td><td>0.7</td><td></td><td>2.0</td><td>3.4</td> </tr> <tr> <td>10.8</td><td>37.7</td><td>33.9</td><td>0.9</td><td>2.0</td><td>4.1</td><td>10.6</td> </tr> <tr> <td>4.5</td><td>45.9</td><td>43.2</td><td>0.9</td><td>0.9</td><td>0.9</td><td>3.6</td> </tr> </table>																0.3	28.8	55.4	11.3	0.9	0.2	1.0	1.9	2.5	52.8	21.6	0.5	1.0	6.5	15.1	0.8	65.7	24.9	4.1		0.4	4.1	4.2	41.7	45.8			4.2	4.2		39.1	60.9					19.9	58.0	13.0	0.5	0.6	6.4	1.6	8.1	61.5	24.3	0.7		2.0	3.4	10.8	37.7	33.9	0.9	2.0	4.1	10.6	4.5	45.9	43.2	0.9	0.9	0.9	3.6																																																																																										
	0.3	28.8	55.4	11.3																	0.9	0.2	1.0	1.9																																																																																																																																																						
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Ground Beef (24)	0.0	8.3	[1.0 - 27.0]																																																																																																																																																																											
Pork Chops (23)	0.0	0.0	[0.0 - 14.8]																																																																																																																																																																											
Chickens (624)	0.6	8.0	[6.0 - 10.4]																																																																																																																																																																											
Turkeys (148)	0.0	5.4	[2.4 - 10.4]																																																																																																																																																																											
Cattle (443)	2.0	14.7	[11.5 - 18.3]																																																																																																																																																																											
Swine (111)	0.9	4.5	[1.5 - 10.2]																																																																																																																																																																											
Ceftiofur	Humans (2379)	0.0	2.9	[2.3 - 3.7]	<table border="1"> <tr> <td>0.2</td><td>0.6</td><td>32.7</td><td>62.1</td><td>1.4</td><td></td><td></td><td>2.9</td> </tr> <tr> <td></td><td></td><td>11.6</td><td>64.8</td><td>1.0</td><td></td><td>1.5</td><td>21.1</td> </tr> <tr> <td></td><td></td><td>7.4</td><td>82.5</td><td>5.7</td><td></td><td></td><td>4.5</td> </tr> <tr> <td></td><td></td><td>8.3</td><td>70.8</td><td>12.5</td><td></td><td></td><td>8.3</td> </tr> <tr> <td></td><td></td><td>13.0</td><td>87.0</td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td>58.2</td><td>32.7</td><td>0.5</td><td></td><td>0.6</td><td>8.0</td> </tr> <tr> <td></td><td></td><td>41.9</td><td>49.3</td><td>3.4</td><td></td><td></td><td>5.4</td> </tr> <tr> <td></td><td>1.4</td><td>36.8</td><td>44.5</td><td>0.9</td><td>0.2</td><td>2.0</td><td>14.2</td> </tr> <tr> <td></td><td>35.1</td><td>55.9</td><td>2.7</td><td>1.8</td><td></td><td></td><td>4.5</td> </tr> </table>																0.2	0.6	32.7	62.1	1.4			2.9			11.6	64.8	1.0		1.5	21.1			7.4	82.5	5.7			4.5			8.3	70.8	12.5			8.3			13.0	87.0							58.2	32.7	0.5		0.6	8.0			41.9	49.3	3.4			5.4		1.4	36.8	44.5	0.9	0.2	2.0	14.2		35.1	55.9	2.7	1.8			4.5																																																																																		
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Ground Beef (24)	0.0	8.3	[1.0 - 27.0]																																																																																																																																																																											
Pork Chops (23)	0.0	0.0	[0.0 - 14.8]																																																																																																																																																																											
Chickens (624)	0.0	8.7	[6.6 - 11.1]																																																																																																																																																																											
Turkeys (148)	0.0	5.4	[2.4 - 10.4]																																																																																																																																																																											
Cattle (443)	0.2	16.3	[12.9 - 20.0]																																																																																																																																																																											
Swine (111)	1.8	4.5	[1.5 - 10.2]																																																																																																																																																																											
Ceftriaxone ⁵	Humans (2379)	0.0	2.9	[2.3 - 3.7]	<table border="1"> <tr> <td>97.0</td><td></td><td></td><td></td><td><0.1</td><td></td><td></td><td>0.3</td><td>1.6</td><td>0.8</td><td>0.2</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0.1</td> </tr> <tr> <td>77.4</td><td></td><td></td><td></td><td></td><td></td><td></td><td>3.0</td><td>15.1</td><td>4.5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>95.5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2.9</td><td>1.2</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0.4</td> </tr> <tr> <td>91.7</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>4.2</td><td></td><td>4.2</td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>100.0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>91.2</td><td>0.2</td><td></td><td></td><td></td><td></td><td></td><td>0.2</td><td>1.4</td><td>5.4</td><td>1.3</td><td>0.2</td><td></td><td></td><td></td><td></td><td>0.2</td> </tr> <tr> <td>93.9</td><td>0.7</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0.7</td><td>2.0</td><td>2.0</td><td>0.7</td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>83.5</td><td></td><td></td><td></td><td></td><td></td><td>0.5</td><td></td><td>0.2</td><td>2.5</td><td>7.9</td><td>4.1</td><td>1.4</td><td></td><td></td><td></td><td></td> </tr> <tr> <td>95.5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2.7</td><td>0.9</td><td></td><td></td><td></td><td></td><td>0.9</td> </tr> </table>																97.0				<0.1			0.3	1.6	0.8	0.2							0.1	77.4							3.0	15.1	4.5								95.5								2.9	1.2							0.4	91.7								4.2		4.2							100.0																	91.2	0.2						0.2	1.4	5.4	1.3	0.2					0.2	93.9	0.7							0.7	2.0	2.0	0.7						83.5						0.5		0.2	2.5	7.9	4.1	1.4					95.5										2.7	0.9					0.9
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Chicken Breasts (199)	0.0	22.6	[17.0 - 29.1]																																																																																																																																																																											
Ground Turkey (245)	0.0	4.5	[2.3 - 7.9]																																																																																																																																																																											
Ground Beef (24)	0.0	8.3	[1.0 - 27.0]																																																																																																																																																																											
Pork Chops (23)	0.0	0.0	[0.0 - 14.8]																																																																																																																																																																											
Chickens (624)	0.0	8.7	[6.6 - 11.1]																																																																																																																																																																											
Turkeys (148)	0.0	5.4	[2.4 - 10.4]																																																																																																																																																																											
Cattle (443)	0.5	16.0	[12.7 - 19.8]																																																																																																																																																																											
Swine (111)	0.0	4.5	[1.5 - 10.2]																																																																																																																																																																											

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates that were resistant

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

⁴ 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 areas 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

⁵ Breakpoints for ceftriaxone were revised to reflect those published in CLSI document M100-S20

Table 7c. Distribution of MICs and Occurrence of Resistance among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, 2008

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 Sulfisoxazole	Humans (2379)	N/A	10.0	[8.9 - 11.3]											16.5	57.0	16.1	0.3	<0.1	10.0	
	Chicken Breasts (199)	N/A	39.2	[32.4 - 46.3]											3.0	18.6	37.7	1.0	0.5	39.2	
	Ground Turkey (245)	N/A	27.3	[21.9 - 33.4]											1.6	32.2	35.9	1.6	1.2	27.3	
	Ground Beef (24)	N/A	20.8	[7.1 - 42.2]												20.8	54.2	4.2		20.8	
	Pork Chops (23)	N/A	30.4	[13.2 - 52.9]												8.7	60.9			30.4	
	Chickens (624)	N/A	13.3	[10.7 - 16.2]												31.7	49.5	5.1	0.2	0.2	13.3
	Turkeys (148)	N/A	24.3	[17.7 - 32.1]												23.0	43.2	9.5			24.3
	Cattle (443)	N/A	24.8	[20.9 - 29.1]												22.1	46.5	6.3	0.2		24.8
	Swine (111)	N/A	31.5	[23.0 - 41.0]												27.9	37.8	2.7			31.5
Trimethoprim-Sulfamethoxazole	Humans (2379)	N/A	1.6	[1.1 - 2.2]	80.8	17.2	0.3	<0.1	<0.1						1.6						
	Chicken Breasts (199)	N/A	0.0	[0.0 - 1.8]	90.5	7.0	2.5														
	Ground Turkey (245)	N/A	0.4	[0.0 - 2.3]	83.7	13.1	2.9					0.4									
	Ground Beef (24)	N/A	0.0	[0.0 - 14.2]	91.7	4.2	4.2														
	Pork Chops (23)	N/A	0.0	[0.0 - 14.8]	91.3	4.4	4.4														
	Chickens (624)	N/A	0.3	[0.0 - 1.2]	92.0	7.7														0.3	
	Turkeys (148)	N/A	1.4	[0.2 - 4.8]	89.2	8.8		0.7												1.4	
	Cattle (443)	N/A	4.5	[2.8 - 6.9]	73.4	20.1	2.0						1.1							3.4	
	Swine (111)	N/A	2.7	[0.6 - 7.7]	77.5	18.0	1.8													2.7	
Penicillins Ampicillin	Humans (2379)	<0.1	9.6	[8.5 - 10.9]							84.2	5.8	0.3		<0.1	0.1	9.5				
	Chicken Breasts (199)	0.0	29.1	[22.9 - 36.0]							60.8	9.6	0.5				29.1				
	Ground Turkey (245)	0.0	50.6	[44.2 - 57.0]							43.3	5.7	0.4			0.4	50.2				
	Ground Beef (24)	0.0	12.5	[2.7 - 32.4]							70.8	16.7					12.5				
	Pork Chops (23)	0.0	13.0	[2.8 - 33.6]							82.6	4.4					13.0				
	Chickens (624)	0.0	10.6	[8.3 - 13.3]							87.5	1.4	0.5			0.2	10.4				
	Turkeys (148)	0.0	32.4	[25.0 - 40.6]							66.9	0.7					32.4				
	Cattle (443)	0.0	21.7	[17.9 - 25.8]							75.8	2.0	0.5				21.7				
	Swine (111)	0.0	14.4	[8.5 - 22.4]							81.1	2.7	0.9	0.9			14.4				
Phenicol Chloramphenicol	Humans (2379)	1.1	6.1	[5.2 - 7.1]							1.2	41.4	50.1	1.1	<0.1	6.1					
	Chicken Breasts (199)	0.0	0.5	[0.0 - 2.8]							1.0	27.1	71.4			0.5					
	Ground Turkey (245)	1.2	1.6	[0.4 - 4.1]								35.1	62.0	1.2		1.6					
	Ground Beef (24)	0.0	12.5	[2.7 - 32.4]								8.3	79.2			12.5					
	Pork Chops (23)	0.0	0.0	[0.0 - 14.8]									100.0								
	Chickens (624)	0.3	1.8	[0.9 - 3.1]							7.7	62.0	28.2	0.3	0.2	1.6					
	Turkeys (148)	0.0	2.7	[0.7 - 6.8]							4.7	59.5	33.1		0.7	2.0					
	Cattle (443)	1.4	19.6	[16.0 - 23.6]							0.5	40.9	37.7	1.4		19.6					
	Swine (111)	2.7	9.9	[5.1 - 17.0]							1.8	32.4	53.2	2.7	0.9	9.0					

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates that were resistant

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

⁴ 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 areas 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

Table 7d. Distribution of MICs and Occurrence of Resistance among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, 2008

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 (2379)	<0.1	<0.1	[0.0 - 0.3]	92.4	5.0	0.2	0.9	0.9	0.4	<0.1	<0.1	<0.1								
	Chicken Breasts (199)	0.0	0.0	[0.0 - 1.8]	81.9	17.1	1.0														
	Ground Turkey (245)	0.0	0.0	[0.0 - 1.5]	78.4	20.4	0.8	0.4													
	Ground Beef (24)	0.0	0.0	[0.0 - 14.2]	95.8	4.2															
	Pork Chops (23)	0.0	0.0	[0.0 - 14.8]	82.6	13.0	4.4														
	Chickens (624)	0.0	0.0	[0.0 - 0.6]	93.4	6.4	0.2														
	Turkeys (148)	0.0	0.0	[0.0 - 2.5]	95.3	4.1	0.7														
	Swine (111)	0.0	0.0	[0.0 - 0.8]	91.9	7.0	0.5	0.7													
Nalidixic Acid	Humans (2379)	N/A	2.0	[1.5 - 2.6]							0.2	0.3	51.3	44.6	1.3	0.3	<0.1	1.9			
	Chicken Breasts (199)	N/A	0.0	[0.0 - 1.8]									26.1	70.4	3.5						
	Ground Turkey (245)	N/A	0.4	[0.0 - 2.3]									18.0	78.4	2.9	0.4	0.4				
	Ground Beef (24)	N/A	0.0	[0.0 - 14.2]									37.5	62.5							
	Pork Chops (23)	N/A	0.0	[0.0 - 14.8]									21.7	73.9	4.4						
	Chickens (624)	N/A	0.0	[0.0 - 0.6]							3.7	57.2	38.6	0.5							
	Turkeys (148)	N/A	0.7	[0.0 - 3.7]							1.4	58.1	39.9			0.7					
	Swine (111)	N/A	0.0	[0.0 - 3.3]									60.0	39.1	0.2	0.7					
Tetracyclines Tetracycline	Humans (2379)	0.2	11.5	[10.2 - 12.8]									88.3	0.2	0.3	3.5	7.7				
	Chicken Breasts (199)	0.5	46.7	[39.6 - 53.9]									52.8	0.5	1.5	45.2					
	Ground Turkey (245)	0.4	66.1	[59.8 - 72.0]									33.5	0.4	4.1		62.0				
	Ground Beef (24)	0.0	20.8	[7.1 - 42.2]									79.2	4.2		16.7					
	Pork Chops (23)	0.0	34.8	[16.4 - 57.3]									65.2			34.8					
	Chickens (624)	1.4	30.4	[26.9 - 34.2]									68.1	1.4	0.5		30.0				
	Turkeys (148)	0.0	64.2	[55.9 - 71.9]									35.8	5.4		58.8					
	Swine (111)	0.0	29.3	[25.1 - 33.8]									70.7	0.2		3.6	25.5				
		0.0	51.4	[41.7 - 61.0]									48.6	0.9		7.2	43.2				

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates that were resistant

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

⁴ 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 areas 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

Resistance by Year

Table 8a. Antimicrobial Resistance among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		
Number of Isolates Tested	Humans	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2379	
	Chicken Breasts						60	83	157	153	152	99	199	
	Ground Turkey						74	114	142	183	159	190	245	
	Ground Beef						9	10	14	8	19	13	24	
	Pork Chops						10	5	11	9	8	18	23	
	Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	
	Turkeys	107	240	713	518	550	244	262	236	227	304	271	148	
	Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443	
	Swine	111	793	876	451	418	379	211	308	301	304	211	111	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Aminoglycosides	Amikacin (MIC ≥ 64 µg/ml)	Humans	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	<0.1%	0.0%	0.0%	
		Chicken Breasts						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
		Ground Turkey						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
		Ground Beef						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
		Pork Chops						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%	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%	0.5%	0.0%
	Gentamicin (MIC ≥ 16 µg/ml)	Humans	2.9%	2.8%	2.1%	2.7%	1.9%	1.4%	1.4%	1.3%	2.2%	2.0%	2.1%	1.5%
		Chicken Breasts						10.0%	6.0%	3.8%	3.3%	9.2%	6.1%	7.0%
		Ground Turkey						14.9%	22.8%	20.4%	26.8%	28.9%	24.7%	27.8%
		Ground Beef						0.0%	0.0%	0.0%	25.0%	0.0%	7.7%	8.3%
		Pork Chops						30.0%	0.0%	0.0%	0.0%	50.0%	5.6%	13.0%
		Chickens	17.8%	15.3%	10.4%	14.9%	7.9%	5.5%	6.3%	4.9%	4.3%	5.7%	4.5%	5.6%
		Turkeys	20.6%	18.3%	17.5%	16.2%	20.9%	19.3%	21.0%	25.4%	22.9%	16.4%	12.9%	16.9%
		Cattle	0.0%	1.8%	1.6%	2.1%	2.1%	2.6%	2.7%	1.8%	2.4%	3.9%	1.6%	1.6%
		Swine	0.9%	0.8%	1.1%	1.3%	1.4%	0.8%	0.5%	1.3%	2.7%	2.0%	0.9%	2.7%
	Kanamycin (MIC ≥ 64 µg/ml)	Humans	5.2%	5.7%	4.4%	5.6%	4.8%	3.8%	3.5%	2.8%	3.4%	2.9%	2.8%	2.1%
		Chicken Breasts						6.7%	4.8%	11.5%	4.6%	9.9%	5.1%	10.6%
		Ground Turkey						18.9%	27.2%	18.3%	20.2%	15.1%	23.7%	18.0%
		Ground Beef						0.0%	0.0%	0.0%	25.0%	5.3%	0.0%	8.3%
		Pork Chops						10.0%	0.0%	9.1%	0.0%	25.0%	5.6%	0.0%
		Chickens	2.3%	3.2%	1.2%	4.1%	2.4%	2.0%	2.8%	2.7%	2.5%	3.6%	3.4%	3.4%
		Turkeys	24.3%	17.1%	21.5%	21.4%	22.9%	24.2%	16.0%	14.4%	19.8%	10.5%	16.2%	14.2%
		Cattle	8.3%	9.5%	7.1%	6.6%	6.9%	10.1%	13.7%	8.9%	13.1%	9.5%	7.7%	9.9%
		Swine	11.7%	7.2%	6.7%	9.3%	6.9%	4.2%	5.7%	3.9%	5.0%	8.6%	7.1%	3.6%
	Streptomycin (MIC ≥ 64 µg/ml)	Humans	21.4%	18.7%	16.7%	16.3%	17.1%	13.2%	15.0%	11.9%	11.1%	10.7%	10.4%	10.0%
		Chicken Breasts						28.3%	26.5%	28.0%	30.1%	36.2%	30.3%	23.6%
		Ground Turkey						37.8%	45.6%	34.5%	44.3%	40.9%	45.8%	58.8%
		Ground Beef						22.2%	40.0%	14.3%	25.0%	10.5%	0.0%	20.8%
		Pork Chops						70.0%	40.0%	27.3%	33.3%	25.0%	16.7%	13.0%
		Chickens	24.3%	27.8%	27.5%	28.6%	21.0%	22.9%	19.6%	22.2%	23.3%	21.2%	19.3%	25.2%
		Turkeys	34.6%	40.8%	43.6%	41.9%	46.7%	37.7%	29.4%	33.9%	40.1%	28.9%	34.7%	32.4%
		Cattle	12.5%	16.2%	15.4%	21.3%	20.3%	25.9%	28.7%	20.9%	24.3%	23.7%	19.8%	23.0%
		Swine	27.9%	29.4%	29.3%	39.2%	35.6%	40.1%	30.8%	36.4%	36.5%	26.3%	27.0%	29.7%

Table 8b. Antimicrobial Resistance among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2379	
	Chicken Breasts						60	83	157	153	152	99	199	
	Ground Turkey						74	114	142	183	159	190	245	
	Ground Beef						9	10	14	8	19	13	24	
	Pork Chops						10	5	11	9	8	18	23	
	Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	
	Turkeys	107	240	713	518	550	244	262	236	227	304	271	148	
	Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443	
Swine	111	793	876	451	418	379	211	308	301	304	211	111		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	1.0%	1.7%	2.3%	3.9%	4.7%	5.3%	4.6%	3.8%	3.2%	3.7%	3.3%	3.0%
		Chicken Breasts	13	25	34	54	66	106	86	67	65	81	70	71
		Ground Turkey						10.0%	25.3%	24.8%	21.6%	19.1%	16.2%	22.6%
		Ground Beef						6	21	39	33	29	16	45
		Pork Chops						12.2%	11.4%	7.7%	8.7%	5.0%	5.3%	5.3%
		Chickens	0.5%	2.0%	4.9%	7.3%	4.5%	22.2%	40.0%	14.3%	0.0%	0.0%	0.0%	8.3%
		Turkeys	4.7%	0.4%	4.3%	3.5%	6.9%	2	4	2	0	0	0	2
		Cattle	8.3%	2.5%	3.9%	9.9%	11.8%	20.0%	20.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Swine	0.0%	0.4%	1.0%	1.8%	2.6%	2	1	0	0	0	0	0
Cephems	Cefoxitin (MIC ≥ 32 µg/ml)	Humans				3.2%	3.4%	4.3%	4.3%	3.5%	3.0%	3.5%	2.9%	2.9%
		Chicken Breasts				44	48	86	79	62	62	77	63	70
		Ground Turkey						10.0%	25.3%	24.8%	20.9%	18.4%	15.2%	21.6%
		Ground Beef						6	21	39	32	28	15	43
		Pork Chops						8.1%	2.6%	4.9%	7.1%	5.0%	5.3%	4.5%
		Chickens				7.2%	4.1%	6	3	7	13	8	10	11
		Turkeys				3.3%	4.5%	22.2%	40.0%	14.3%	0.0%	0.0%	0.0%	8.3%
		Cattle				85	53	2	4	2	0	0	0	2
		Swine				17	25	20.0%	20.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	0.5%	0.8%	2.0%	3.2%	4.1%	4.4%	4.5%	3.4%	2.9%	3.6%	3.3%	2.9%
		Chicken Breasts	6	12	30	44	58	87	83	61	60	79	70	70
		Ground Turkey						10.0%	25.3%	24.8%	20.9%	19.1%	16.2%	22.6%
		Ground Beef						6	21	39	32	29	16	45
		Pork Chops						8.1%	2.6%	4.9%	7.1%	5.0%	5.3%	4.5%
		Chickens	0.5%	2.0%	5.2%	7.6%	4.1%	22.2%	40.0%	14.3%	0.0%	0.0%	0.0%	8.3%
		Turkeys	3.7%	0.4%	4.6%	3.3%	5.1%	2	4	2	0	0	0	2
		Cattle	0.0%	2.1%	4.2%	9.8%	11.4%	20.0%	20.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Swine	0.0%	0.1%	1.9%	1.3%	2.2%	2	1	0	0	0	0	0
	Ceftriaxone (MIC ≥ 4 µg/ml) ¹	Humans	0.5%	0.8%	2.0%	3.2%	3.7%	4.4%	4.4%	3.4%	2.9%	3.7%	3.3%	2.9%
		Chicken Breasts	7	12	30	44	52	87	81	60	59	80	70	70
		Ground Turkey						10.0%	26.5%	24.8%	21.6%	19.1%	16.2%	22.6%
		Ground Beef						6	22	39	33	29	16	45
		Pork Chops						8.1%	2.6%	5.6%	7.1%	5.0%	5.8%	4.5%
		Chickens	0.5%	1.8%	4.6%	7.4%	4.1%	6	3	8	13	8	11	11
		Turkeys	3.7%	0.4%	4.2%	3.1%	4.7%	22.2%	40.0%	14.3%	0.0%	0.0%	0.0%	8.3%
		Cattle	0.0%	2.1%	3.9%	9.9%	11.3%	2	4	2	0	0	0	2
		Swine	0.0%	0.1%	1.3%	1.3%	2.2%	20.0%	20.0%	0.0%	0.0%	0.0%	0.0%	0.0%
							2	1	0	0	0	0	0	
		0.5%	1.8%	4.6%	7.4%	4.1%	9.9%	9.7%	12.3%	12.2%	12.8%	15.6%	8.7%	
		1	10	66	87	54	153	113	159	242	177	153	54	
		3.7%	0.4%	4.2%	3.1%	4.7%	3.3%	1.1%	4.7%	3.5%	5.3%	11.1%	5.4%	
		4	1	30	16	26	8	3	11	8	16	30	8	
		0.0%	2.1%	3.9%	9.9%	11.3%	17.3%	21.0%	13.5%	20.7%	18.5%	15.9%	16.0%	
	0	6	63	137	101	174	141	82	68	72	70	71		
	0.0%	0.1%	1.3%	1.3%	2.2%	2.9%	4.3%	1.6%	3.7%	1.6%	2.4%	4.5%		
	0	1	11	6	9	11	9	5	11	5	5	5		

¹ Breakpoints for ceftriaxone were revised to reflect those published in CLSI document M100-S20

Table 8c. Antimicrobial Resistance among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		
Number of Isolates Tested	Humans	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2379		
	Chicken Breasts						60	83	157	153	152	99	199		
	Ground Turkey						74	114	142	183	159	190	245		
	Ground Beef						9	10	14	8	19	13	24		
	Pork Chops						10	5	11	9	8	18	23		
	Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624		
	Turkeys	107	240	713	518	550	244	262	236	227	304	271	148		
	Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443		
	Swine	111	793	876	451	418	379	211	308	301	304	211	111		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source													
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole ¹ (MIC ≥ 512 µg/ml)	Humans	22.7%	19.5%	18.0%	17.1%	17.8%	12.9%	15.1%	13.2%	12.6%	12.1%	12.3%	10.0%	
			295	283	269	234	251	258	280	236	256	263	264	239	
		Chicken Breasts							16.7%	14.5%	28.7%	17.0%	23.0%	25.3%	39.2%
									10	12	45	26	35	25	78
		Ground Turkey							20.3%	33.3%	28.2%	34.4%	32.1%	34.7%	27.4%
									15	38	40	63	51	66	67
		Ground Beef							22.2%	40.0%	14.3%	25.0%	10.5%	7.7%	20.8%
									2	4	2	2	2	1	5
		Pork Chops							70.0%	40.0%	18.2%	33.3%	75.0%	16.7%	30.4%
									7	2	2	3	6	3	7
	Chickens	24.8%	23.7%	15.9%	18.4%	11.8%	8.9%	10.3%	11.9%	8.5%	10.7%	10.4%	13.3%		
		53	133	229	216	154	133	119	152	169	148	103	83		
	Turkeys	37.4%	32.1%	36.0%	25.1%	38.0%	30.3%	28.2%	36.4%	37.0%	27.3%	25.5%	24.3%		
		40	77	257	130	209	74	74	86	84	83	69	36		
	Cattle	20.8%	15.5%	15.0%	19.9%	19.7%	22.3%	25.1%	22.7%	27.4%	24.2%	21.6%	24.8%		
		5	44	242	276	176	225	168	138	90	94	95	110		
	Swine	34.2%	29.0%	30.7%	35.7%	34.9%	34.6%	25.1%	37.0%	32.9%	26.6%	30.8%	31.5%		
		38	230	269	161	146	131	53	114	99	81	65	35		
	Trimethoprim- Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	1.9%	2.3%	2.0%	2.0%	2.0%	1.4%	1.9%	1.7%	1.7%	1.7%	1.5%	1.6%	
			24	34	30	28	28	28	36	31	34	36	33	37	
Chicken Breasts								0.0%	0.0%	0.0%	0.0%	1.3%	0.0%		
								0	0	0	0	2	0		
Ground Turkey								1.4%	0.0%	0.0%	0.5%	0.0%	0.5%		
								1	0	0	1	0	1		
Ground Beef								0.0%	0.0%	7.1%	0.0%	0.0%	0.0%		
								0	0	1	0	0	0		
Pork Chops								20.0%	0.0%	0.0%	11.1%	50.0%	5.6%		
								2	0	0	1	4	1		
Chickens	0.5%	1.2%	1.1%	0.4%	0.5%	0.8%	0.3%	0.2%	0.2%	0.1%	0.0%	0.3%			
	1	7	16	5	6	12	4	3	4	1	0	2			
Turkeys	3.7%	2.5%	4.2%	1.5%	2.5%	2.5%	2.3%	0.8%	1.8%	1.0%	1.1%	1.4%			
	4	6	30	8	14	6	6	2	4	3	3	2			
Cattle	4.2%	2.5%	2.4%	2.2%	2.6%	2.5%	3.3%	1.5%	4.9%	4.6%	3.0%	4.5%			
	1	7	39	30	23	25	22	9	16	18	13	20			
Swine	1.8%	0.3%	1.1%	0.9%	0.0%	1.6%	2.4%	1.6%	2.3%	2.0%	1.9%	2.7%			
	2	2	10	4	0	6	5	5	7	6	4	3			
Penicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	18.3%	16.6%	15.5%	15.9%	17.5%	13.0%	13.6%	12.1%	11.4%	11.0%	10.1%	9.6%	
			237	241	232	218	247	259	253	216	232	238	217	229	
		Chicken Breasts							16.7%	33.7%	30.6%	26.8%	22.4%	18.2%	
									10	28	48	41	34	18	
		Ground Turkey							16.2%	28.9%	20.4%	26.8%	25.8%	42.6%	
									12	33	29	49	41	81	
		Ground Beef							22.2%	40.0%	21.4%	25.0%	10.5%	0.0%	
									2	4	3	2	2	0	
		Pork Chops							40.0%	40.0%	9.1%	22.2%	25.0%	5.6%	
									4	2	1	2	2	1	
Chickens	11.7%	12.8%	12.4%	13.0%	9.4%	14.3%	13.7%	14.5%	14.0%	14.9%	17.0%	10.6%			
	25	72	179	152	123	215	159	185	279	205	169	66			
Turkeys	12.1%	10.4%	17.7%	16.2%	19.5%	18.0%	18.7%	22.0%	22.9%	25.3%	36.9%	32.4%			
	13	25	126	84	107	44	49	52	52	77	100	48			
Cattle	12.5%	9.2%	12.5%	18.7%	17.9%	23.9%	28.1%	19.3%	26.7%	22.4%	20.0%	21.7%			
	3	26	202	259	160	241	188	117	88	87	88	96			
Swine	16.2%	12.9%	10.8%	18.8%	11.7%	13.7%	12.8%	16.2%	13.6%	11.5%	18.0%	14.4%			
	18	102	95	85	49	52	27	50	41	35	38	16			
Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	10.0%	10.0%	9.2%	10.1%	11.6%	8.6%	10.1%	7.6%	7.8%	6.4%	7.3%	6.1%	
			130	145	137	138	164	172	187	135	159	139	156	145	
		Chicken Breasts							0.0%	2.4%	1.9%	0.7%	2.6%	1.0%	
									0	2	3	1	4	1	
		Ground Turkey							1.4%	0.9%	2.8%	0.5%	0.6%	1.6%	
									1	1	4	1	1	3	
		Ground Beef							22.2%	40.0%	14.3%	12.5%	5.3%	0.0%	
									2	4	2	1	1	0	
		Pork Chops							40.0%	40.0%	18.2%	22.2%	0.0%	0.0%	
									4	2	2	2	0	0	
Chickens	2.3%	2.9%	1.8%	4.6%	2.5%	2.4%	2.1%	1.3%	1.8%	1.7%	1.8%	1.8%			
	5	16	26	54	33	36	24	16	36	24	18	11			
Turkeys	3.7%	0.8%	4.1%	4.1%	3.8%	5.3%	4.2%	4.7%	4.8%	3.9%	5.5%	2.7%			
	4	2	29	21	21	13	11	11	11	12	15	4			
Cattle	4.2%	5.6%	8.5%	15.1%	16.5%	20.6%	25.1%	17.6%	21.9%	19.8%	20.0%	19.6%			
	1	16	137	209	147	208	168	107	72	77	88	87			
Swine	11.7%	8.4%	8.0%	12.4%	7.7%	10.0%	8.5%	12.7%	10.6%	7.9%	15.2%	9.9%			
	13	67	70	56	32	38	18	39	32	24	32	11			

¹ Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

Table 8d. Antimicrobial Resistance among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

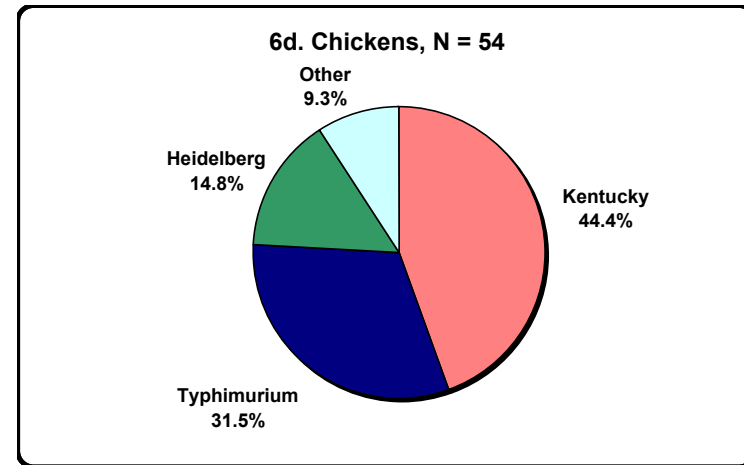
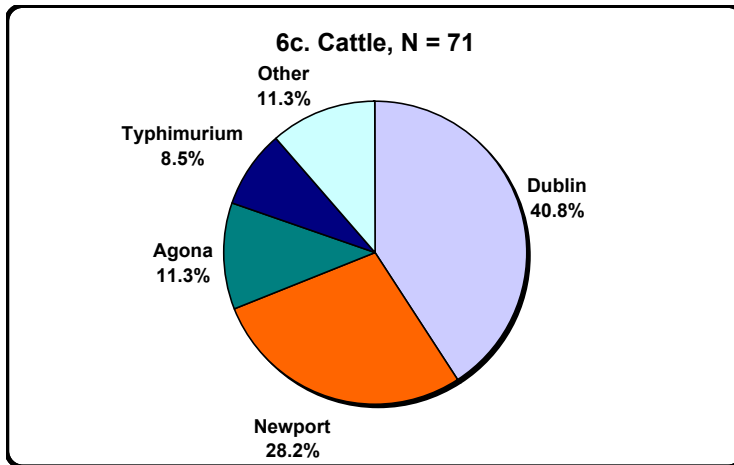
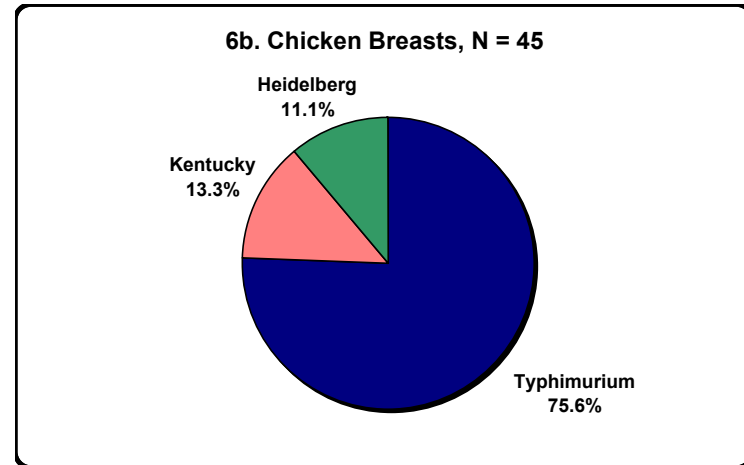
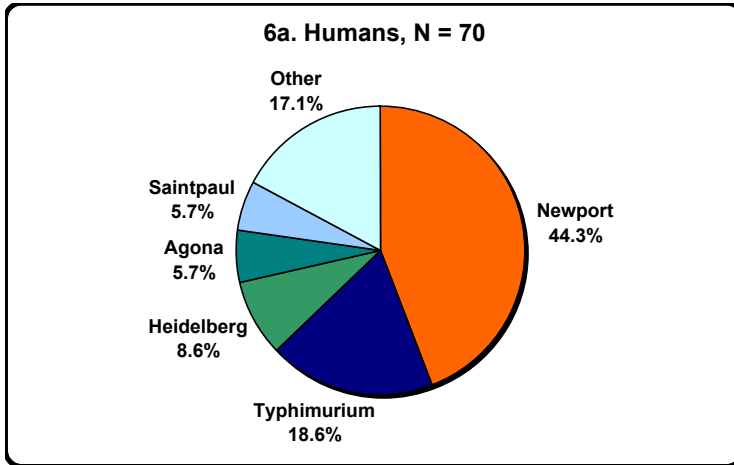
Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2379	
	Chicken Breasts						60	83	157	153	152	99	199	
	Ground Turkey						74	114	142	183	159	190	245	
	Ground Beef						9	10	14	8	19	13	24	
	Pork Chops						10	5	11	9	8	18	23	
	Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	
	Turkeys	107	240	713	518	550	244	262	236	227	304	271	148	
	Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443	
Swine	111	793	876	451	418	379	211	308	301	304	211	111		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	0.0%	0.1%	0.1%	0.4%	0.2%	<0.1%	0.2%	0.2%	<0.1%	0.1%	0.1%	<0.1%
		Chicken Breasts	0	1	1	5	3	0	0	0	0	0	0	0
		Ground Turkey						0	0	0	0	0	0	0
		Ground Beef						0	0	0	0	0	0	0
		Pork Chops						0	0	0	0	0	0	0
		Chickens	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
		Turkeys	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
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	0.9%	1.3%	0.9%	2.3%	2.3%	1.6%	1.9%	2.2%	1.9%	2.4%	2.2%	2.0%
		Chicken Breasts	12	19	14	32	32	32	36	39	38	52	48	47
		Ground Turkey						0	1	0	1	1	0	0
		Ground Beef						8.1%	4.4%	0.0%	1.1%	0.0%	2.6%	0.4%
		Pork Chops						6	5	0	2	0	5	1
		Chickens	0.0%	0.2%	0.2%	0.5%	0.0%	0	12	5	6	6	2	1
		Turkeys	4.7%	2.1%	5.3%	5.4%	5.1%	5	13	10	5	5	2	3
		Cattle	0	1	1	6	4	0	4	3	12	5	2	3
		Swine	0.0%	0.0%	0.0%	0.2%	0.0%	0	1	0	0	1	0	0
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	21.7%	20.3%	19.4%	18.7%	19.9%	14.9%	16.3%	13.5%	13.9%	13.5%	14.5%	11.5%
		Chicken Breasts	281	295	289	256	280	298	303	241	282	293	310	273
		Ground Turkey						33.3%	27.7%	46.5%	43.8%	46.7%	41.4%	46.7%
		Ground Beef						20	23	73	67	71	41	93
		Pork Chops						55.4%	39.5%	56.3%	39.9%	56.0%	67.4%	66.1%
		Chickens	20.6%	20.5%	25.0%	26.3%	21.9%	41	45	80	73	89	128	162
		Turkeys	52.3%	45.8%	52.9%	56.2%	54.9%	2	4	2	1	4	0	5
		Cattle	25.0%	24.3%	20.9%	25.8%	26.3%	70.0%	80.0%	54.5%	55.6%	25.0%	50.0%	34.8%
		Swine	58	377	424	245	222	7	4	6	5	2	9	8
			44	115	359	308	286	24.9%	26.2%	27.4%	28.3%	31.8%	35.5%	30.4%
			56	110	377	291	302	374	303	351	563	439	353	190
			6	69	336	358	235	323	247	193	112	118	120	130
	58	377	424	245	222	219	91	181	165	191	115	57		

Ceftriaxone Resistance

Table 9. Ceftriaxone-Resistant Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Source and Serotype, 2008

Humans				Retail Meats				Food Animals					
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%		
Humans (N=70)	Newport	31	44.3	Chicken Breasts (N=45)	Typhimurium	34	75.6	Chickens (N=54)	Kentucky	24	44.4		
	Typhimurium	13	18.6		Kentucky	6	13.3		Typhimurium	17	31.5		
	Heidelberg	6	8.6		Heidelberg	5	11.1		Heidelberg	8	14.8		
	Agona	4	5.7						Enteritidis	1	1.9		
	Saintpaul	4	5.7						I 4,5,12:i:-	1	1.9		
	Concord	3	4.3						I 4,5,12:r:-	1	1.9		
	I 4,[5],12:i:-	3	4.3						Newport	1	1.9		
	Dublin	2	2.9						Orion	1	1.9		
	Hato	1	1.4										
	Javiana	1	1.4										
	Kentucky	1	1.4		Ground Turkey (N=11)	Anatum	3		27.3	Turkeys (N=8)	Newport	2	25.0
	Partially serotyped	1	1.4			Heidelberg	2		18.2		Senftenberg	2	25.0
						Senftenberg	2		18.2		Agona	1	12.5
						Agona	1		9.1		Brandenburg	1	12.5
			Alachua	1		9.1	Heidelberg	1	12.5				
			Brandenburg	1		9.1	Ill 18:z4,z23:-	1	12.5				
			Typhimurium	1	9.1								
			Ground Beef (N=2)	Newport	2	100.0	Cattle (N=71)	Dublin	29	40.8			
								Newport	20	28.2			
								Agona	8	11.3			
								Typhimurium	6	8.5			
								I 9,12:-:-	2	2.8			
								Reading	2	2.8			
								Cerro	1	1.4			
			Pork Chops (N=0)				Give	1	1.4				
							Heidelberg	1	1.4				
							Uganda	1	1.4				
						Swine (N=5)	Derby	2	40.0				
							Agona	1	20.0				
							Anatum	1	20.0				
							Newport	1	20.0				

Figures 6a-d. Ceftriaxone-Resistant Non-Typhoidal *Salmonella* Isolates, by Source and Serotype, 2008¹



¹Pie charts are not provided for other sources due to the small number of ceftriaxone-resistant isolates. Table 9 shows a complete listing of ceftriaxone-resistant isolates by source and serotype

Figure 7. Percent of Non-Typhoidal *Salmonella* Isolates from Humans, Retail Poultry, and Poultry Resistant to Ceftriaxone, by Year, 1996-2008

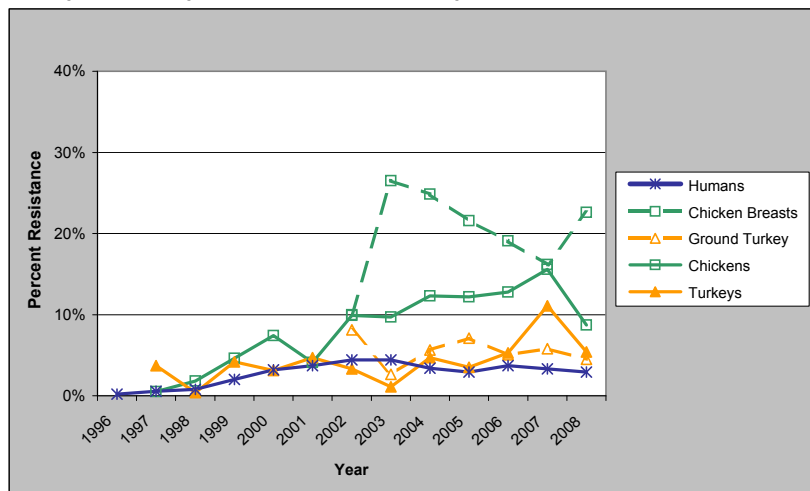
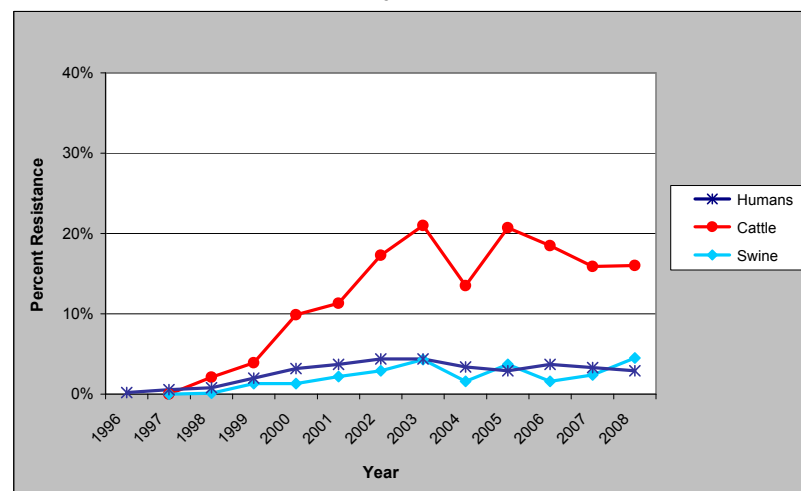


Figure 8. Percent of Non-Typhoidal *Salmonella* Isolates from Humans, Cattle, and Swine Resistant to Ceftriaxone, by Year, 1996-2008¹



¹ Data for ground beef and pork chops are not included due to the small number of *Salmonella* isolates from these sources. Table 8 contains resistance data for *Salmonella* isolates from each source, by year

Table 10. Number of Non-Typhoidal *Salmonella* Isolates Tested from Humans, Retail Meats, and Food Animals, by Year, 1996-2008

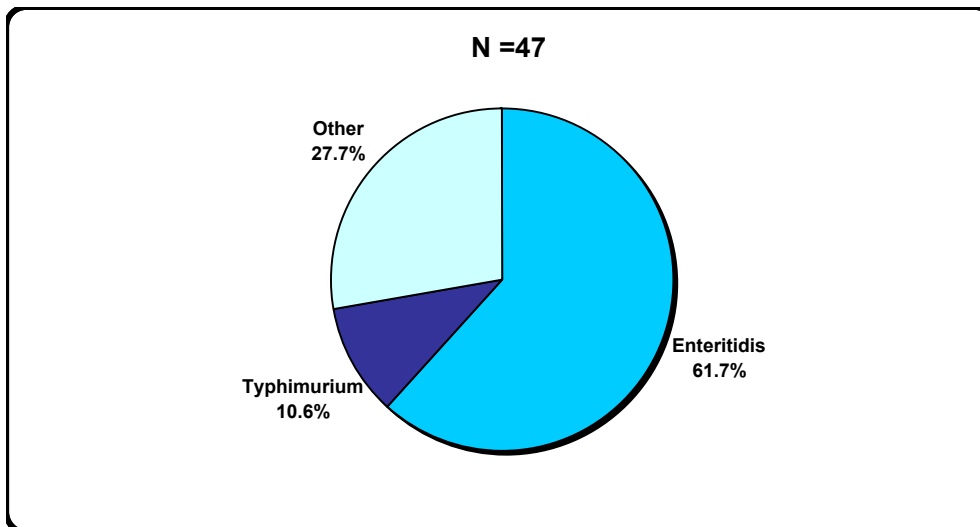
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	1318	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2379
Chicken Breasts							60	83	157	153	152	99	199
Ground Turkey							74	114	142	183	159	190	245
Ground Beef							9	10	14	8	19	13	24
Pork Chops							10	5	11	9	8	18	23
Chickens		214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624
Turkeys		107	240	713	518	550	244	262	236	227	304	271	148
Cattle		24	284	1610	1388	893	1008	670	607	329	389	439	443
Swine		111	793	876	451	418	379	211	308	301	304	211	111

Nalidixic Acid Resistance

Table 11. Nalidixic Acid-Resistant Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Source and Serotype, 2008

Humans				Retail Meats				Food Animals				
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%	
Humans (N=47)	Enteritidis	29	61.7	Chicken Breasts (N=0)				Chickens (N=0)				
	Typhimurium	5	10.6									
	Agona	1	2.1									
	Anatum	1	2.1									
	Choleraesuis	1	2.1									
	Hadar	1	2.1									
	I 4,[5],12:i:-	1	2.1									
	Infantis	1	2.1									
	Javiana	1	2.1									
	Newport	1	2.1									
	Senftenberg	1	2.1									
	Stanley	1	2.1									
	Virchow	1	2.1									
	Unknown	1	2.1									
	Rough/non-motile	1	2.1									
				Ground Turkey (N=1)	Hadar	1	100.0	Turkeys (N=1)	Muenster	1	100.0	
				Ground Beef (N=0)				Cattle (N=3)	Agona	1	33.3	
									Dublin	1	33.3	
									Uganda	1	33.3	
				Pork Chops (N=0)				Swine (N=0)				

Figure 9. Nalidixic Acid-Resistant Non-Typhoidal *Salmonella* Isolates from Humans, by Serotype, 2008¹



¹ Pie charts are not provided for other sources due to the small number of nalidixic acid-resistant isolates. Table 11 above shows a complete listing of nalidixic acid-resistant isolates by source and serotype

Figure 10. Percent of Non-Typhoidal *Salmonella* Isolates from Humans, Retail Poultry, and Poultry Resistant to Nalidixic Acid, by Year, 1996-2008

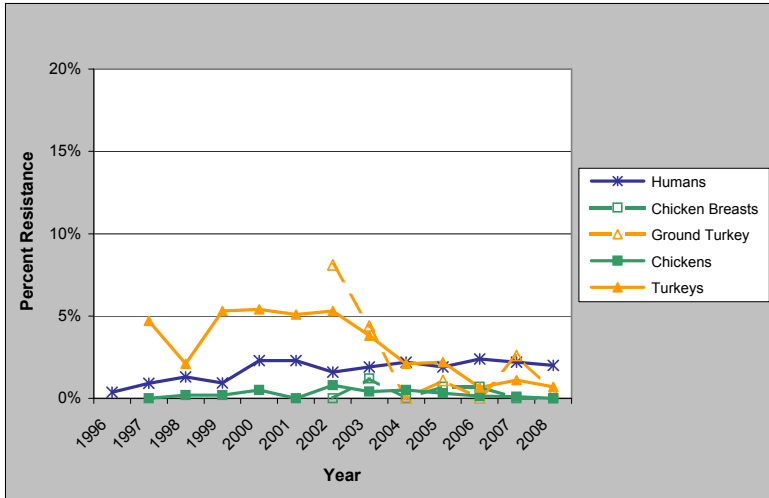
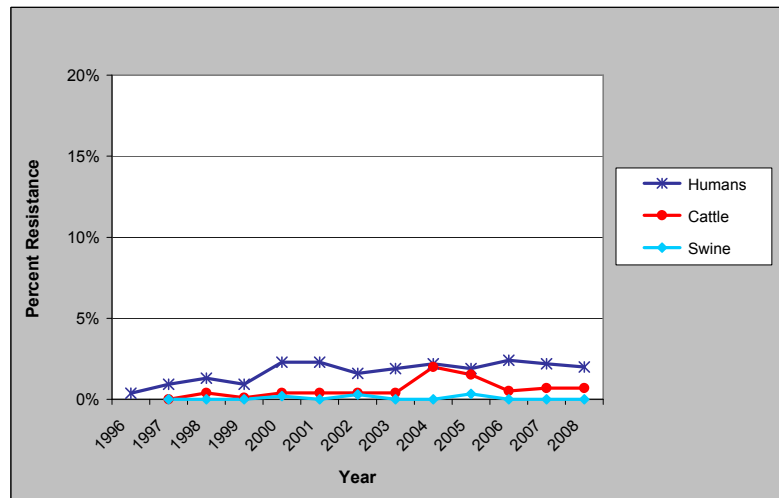


Figure 11. Percent of non-Typhoidal *Salmonella* Isolates from Humans, Cattle, and Swine Resistant to Nalidixic Acid, by Year, 1996-2008¹



¹ Data for ground beef and pork chops are not included due to the small number of *Salmonella* isolates from these sources. Table 8 contains resistance data for *Salmonella* isolates from each source, by year

Table 12. Number of Non-Typhoidal *Salmonella* Isolates Tested from Humans, Retail Meats, and Food Animals, by Year, 1996-2008

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	1318	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2379
Chicken Breasts							60	83	157	153	152	99	199
Ground Turkey							74	114	142	183	159	190	245
Ground Beef							9	10	14	8	19	13	24
Pork Chops							10	5	11	9	8	18	23
Chickens		214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624
Turkeys		107	240	713	518	550	244	262	236	227	304	271	148
Cattle		24	284	1610	1388	893	1008	670	607	329	389	439	443
Swine		111	793	876	451	418	379	211	308	301	304	211	111

Resistance among Top *Salmonella* Serotypes

Table 13. Number of Resistant Non-Typhoidal *Salmonella* Isolates from Humans, by Serotype, 2008

<i>Salmonella</i> Serotype	No. of Isolates	% of Isolates	Number of Resistant Isolates by Antimicrobial Agent ¹ and Class																			
			Number of Antimicrobial Classes in Resistance Pattern						Aminoglycosides		β-Lactam/β-Lactamase Inhibitor Combinations	Cephems			Folate Pathway Inhibitors		Penicillins	Phenolics		Quinolones		Tetracyclines
			0	1	2-3	4-5	6-7	8	AMI	GEN	KAN	STR	AMC	FOX	TIO	AXO	FIS	COT	AMP	CHL	CIP	NAL
Enteritidis	439	18.5%	386	46	7										5	4	16	2			29	7
Typhimurium	397	16.7%	270	3	26	88	10	6	9	113	13	13	13	13	120	7	104	92			5	109
Newport	252	10.6%	215	3		3	31	1	8	34	31	31	31	33	8		36	30			1	35
Javiana	118	5.0%	115	2	1						1	2	1	1			1					
Saintpaul	108	4.5%	98	3	6		1			2	4	4	4	4	2		7	1				5
I 4,[5],12:i-	83	3.5%	64	5	8	4	2	3	1	9	3	3	3	3	11	4	7	5			1	14
Heidelberg	75	3.2%	43	2	20	10		11	20	23	6	6	6	6	9	2	21	1				27
Montevideo	68	2.9%	65		3			2		2					3							1
Braenderup	56	2.4%	55	1													1					
Infantis	51	2.1%	49		1	1				1					2	1	1		1		1	2
Muenchen	51	2.1%	49	1	1										2	1						1
Oranienburg	50	2.1%	49	1																		1
Other	631	26.5%	541	19	45	16	10	11	11	51	13	11	12	12	52	10	35	13	2	9		71
Total	2379	100.0%	1999	86	118	122	54	35	49	237	71	70	70	70	239	37	229	145	2	47	273	

¹ AMI= Amikacin, GEN= Gentamicin, KAN= Kanamycin, STR= Streptomycin, AMC= Amoxicillin/Clavulanic Acid, FOX= Cefoxitin, TIO= Ceftiofur, AXO= Ceftriaxone, FIS= Sulfisoxazole
COT= Trimethoprim/Sulfamethoxazole, AMP= Ampicillin, CHL= Chloramphenicol, CIP= Ciprofloxacin, NAL= Nalidixic Acid, TET= Tetracycline

Table 14. Number of Resistant Non-Typhoidal *Salmonella* Isolates from Chicken Breasts, by Serotype, 2008

<i>Salmonella</i> Serotype	No. of Isolates	% of Isolates	Number of Resistant Isolates by Antimicrobial Agent ¹ and Class																			
			Number of Antimicrobial Classes in Resistance Pattern						Aminoglycosides		β-Lactam/β-Lactamase Inhibitor Combinations	Cephems			Folate Pathway Inhibitors		Penicillins	Phenolics		Quinolones		Tetracyclines
			0	1	2-3	4-5	6-7	8	AMI	GEN	KAN	STR	AMC	FOX	TIO	AXO	FIS	COT	AMP	CHL	CIP	NAL
Typhimurium	68	34.2%	3	27	30	8		1	17	11	34	32	34	34	65		42					64
Enteritidis	30	15.1%	27	2	1			1		1					1		2					1
Heidelberg	30	15.1%	15	11	4			9	4	12	5	5	5	5	9		7	1				8
Kentucky	30	15.1%	8	2	16	4		2		20	6	6	6	6	2		6					17
Mbandaka	7	3.5%	7																			
Infantis	5	2.5%	5																			
I 4,[5],12:i-	4	2.0%	4																			
Montevideo	4	2.0%	4																			
Senftenberg	4	2.0%	4																			
Other	17	8.5%	14		3			1		3					1		1					3
Total	199	100.0%	91	4	58	38	8	14	21	47	45	43	45	45	78	58	1	1	1	1	1	93

¹ AMI= Amikacin, GEN= Gentamicin, KAN= Kanamycin, STR= Streptomycin, AMC= Amoxicillin/Clavulanic Acid, FOX= Cefoxitin, TIO= Ceftiofur, AXO= Ceftriaxone, FIS= Sulfisoxazole
COT= Trimethoprim/Sulfamethoxazole, AMP= Ampicillin, CHL= Chloramphenicol, CIP= Ciprofloxacin, NAL= Nalidixic Acid, TET= Tetracycline

Table 15. Number of Resistant Non-Typhoidal *Salmonella* Isolates from Ground Turkey, by Serotype, 2008

<i>Salmonella</i> Serotype	No. of Isolates	% of Isolates	Number of Resistant Isolates by Antimicrobial Agent ¹ and Class																										
			Number of Antimicrobial Classes in Resistance Pattern						Aminoglycosides				β-Lactam/β-Lactamase Inhibitor Combinations		Cephems			Folate Pathway Inhibitors		Penicillins		Phenicol		Quinolones		Tetracyclines			
			0	1	2-3	4-5	6-7	8	AMI	GEN	KAN	STR	AMC	FOX	TIO	AXO	FIS	COT	AMP	CHL	CIP	NAL	TET						
Hadar	70	28.6%			57	13					10	7	70												1	68			
Heidelberg	56	22.9%	1	4	40	11					32	30	40	4			2	2	2		16						47		
Saintpaul	31	12.7%	9	7	14	1					3	1	8								5						13		
Illa 18:z4,z23:-	16	6.5%	15			1					1	1	1								1			1			1		
Senftenberg	9	3.7%	4	2	1	2					2	2	3	2			2	2	2		2						3		
Anatum	7	2.9%	3		1	3					1		1	3			3	3	3		1						3		
Derby	6	2.4%	1		4	1					4		5								4						1		
Schwarzengrund	6	2.4%	5		1																1						1		
Albany	5	2.0%			5						5		5								5						1		
Berta	5	2.0%	1	3	1						1										3						2		
Reading	5	2.0%	2	3																							2		
Other	29	11.8%	10	4	10	2	3				9	3	11	4			4	4	4		11	1					7		
Total	245	100.0%	51	23	134	32	5				68	44	144	13			11	11	11		67	1				124	4	1	162

¹ AMI= Amikacin, GEN= Gentamicin, KAN= Kanamycin, STR= Streptomycin, AMC= Amoxicillin/Clavulanic Acid, FOX= Cefoxitin, TIO= Ceftiofur, AXO= Ceftriaxone, FIS= Sulfisoxazole
COT= Trimethoprim/Sulfamethoxazole, AMP= Ampicillin, CHL= Chloramphenicol, CIP= Ciprofloxacin, NAL= Nalidixic Acid, TET= Tetracycline

Table 16. Number of Resistant Non-Typhoidal *Salmonella* Isolates from Ground Beef, by Serotype, 2008

<i>Salmonella</i> Serotype	No. of Isolates	% of Isolates	Number of Resistant Isolates by Antimicrobial Agent ¹ and Class																										
			Number of Antimicrobial Classes in Resistance Pattern						Aminoglycosides				β-Lactam/β-Lactamase Inhibitor Combinations		Cephems			Folate Pathway Inhibitors		Penicillins		Phenicol		Quinolones		Tetracyclines			
			0	1	2-3	4-5	6-7	8	AMI	GEN	KAN	STR	AMC	FOX	TIO	AXO	FIS	COT	AMP	CHL	CIP	NAL	TET						
Mbandaka	6	25.0%	6																										
Newport	3	12.5%	1			2							2				2	2	2		2								2
Bareilly	2	8.3%	2									1	2																
Montevideo	2	8.3%	2																										
Norwich	2	8.3%	2																										
Typhimurium	2	8.3%	1		1								1								1				1				1
Brandenburg	1	4.2%	1																										
Enteritidis	1	4.2%	1																										
Heidelberg	1	4.2%			1						1	1	1								1								1
Kentucky	1	4.2%	1																										
Meleagridis	1	4.2%	1																										
Saintpaul	1	4.2%			1						1		1																1
Uganda	1	4.2%	1																										
Total	24	100.0%	19	2	1	2					2	2	5	2			2	2	2		5					3	3		5

¹ AMI= Amikacin, GEN= Gentamicin, KAN= Kanamycin, STR= Streptomycin, AMC= Amoxicillin/Clavulanic Acid, FOX= Cefoxitin, TIO= Ceftiofur, AXO= Ceftriaxone, FIS= Sulfisoxazole
COT= Trimethoprim/Sulfamethoxazole, AMP= Ampicillin, CHL= Chloramphenicol, CIP= Ciprofloxacin, NAL= Nalidixic Acid, TET= Tetracycline

Table 17. Number of Resistant Non-Typhoidal *Salmonella* Isolates from Pork Chops, by Serotype, 2008

<i>Salmonella</i> Serotype	No. of Isolates	% of Isolates	Number of Resistant Isolates by Antimicrobial Agent ¹ and Class																				
			Number of Antimicrobial Classes in Resistance Pattern						Aminoglycosides		β-Lactam/β-Lactamase Inhibitor Combinations	Cephems			Folate Pathway Inhibitors		Penicillins	Phenicol		Quinolones		Tetracyclines	
			0	1	2-3	4-5	6-7	8	AMI	GEN	KAN	STR	AMC	FOX	TIO	AXO	FIS	COT	AMP	CHL	CIP	NAL	TET
			Number of Isolates																				
Mbandaka	6	26.1%	6																				
Adelaide	3	13.0%	3																				
Typhimurium	3	13.0%	2	1																			
Alachua	2	8.7%	2																				
Bareilly	2	8.7%	2																				
Johannesburg	2	8.7%	1	1																			
Derby	1	4.3%	1																				
Infantis	1	4.3%	1																				
Norwich	1	4.3%	1																				
Senftenberg	1	4.3%	1																				
Uganda	1	4.3%	1																				
Total	23	100.0%	15	1	4	3	3	3												8			

¹ AMI= Amikacin, GEN= Gentamicin, KAN= Kanamycin, STR= Streptomycin, AMC= Amoxicillin/Clavulanic Acid, FOX= Cefoxitin, TIO= Ceftiofur, AXO= Ceftriaxone, FIS= Sulfisoxazole
COT= Trimethoprim/Sulfamethoxazole, AMP= Ampicillin, CHL= Chloramphenicol, CIP= Ciprofloxacin, NAL= Nalidixic Acid, TET= Tetracycline

Table 18. Number of Resistant Non-Typhoidal *Salmonella* Isolates from Chickens, by Serotype, 2008

<i>Salmonella</i> Serotype	No. of Isolates	% of Isolates	Number of Resistant Isolates by Antimicrobial Agent ¹ and Class																				
			Number of Antimicrobial Classes in Resistance Pattern						Aminoglycosides		β-Lactam/β-Lactamase Inhibitor Combinations	Cephems			Folate Pathway Inhibitors		Penicillins	Phenicol		Quinolones		Tetracyclines	
			0	1	2-3	4-5	6-7	8	AMI	GEN	KAN	STR	AMC	FOX	TIO	AXO	FIS	COT	AMP	CHL	CIP	NAL	TET
			Number of Isolates																				
Kentucky	219	35.1%	87	25	86	17	4	7	4	113	24	23	24	24	9	25	5					112	
Enteritidis	116	18.6%	113	2		1																	
Heidelberg	94	15.1%	66	6	18	2	2	10	8	15	8	8	8	8	12	13	4					13	
Typhimurium	70	11.2%	19	1	32	15	3	4	6	4	17	14	17	17	49	20	1					45	
I 4,[5],12:i:-	29	4.6%	24	2	3			2	3			1	1	1	1	2	2					1	
Infantis	14	2.2%	14																				
Montevideo	13	2.1%	6	4	3			7	2	6													
Schwarzengrund	7	1.1%	7																				
Senftenberg	6	1.0%	5																				
Other	56	9.0%	36	3	14	1	2	5	1	16	3	3	3	3	6	1	3	1					17
Total	624	100.0%	377	43	157	36	11	35	21	157	54	50	54	54	83	2	66	11					190

¹ AMI= Amikacin, GEN= Gentamicin, KAN= Kanamycin, STR= Streptomycin, AMC= Amoxicillin/Clavulanic Acid, FOX= Cefoxitin, TIO= Ceftiofur, AXO= Ceftriaxone, FIS= Sulfisoxazole
COT= Trimethoprim/Sulfamethoxazole, AMP= Ampicillin, CHL= Chloramphenicol, CIP= Ciprofloxacin, NAL= Nalidixic Acid, TET= Tetracycline

Table 19. Number of Resistant Non-Typhoidal *Salmonella* Isolates from Turkey, by Serotype, 2008

<i>Salmonella</i> Serotype	No. of Isolates	% of Isolates	Number of Resistant Isolates by Antimicrobial Agent ¹ and Class																								
			Number of Antimicrobial Classes in Resistance Pattern						Aminoglycosides				β-Lactam/β-Lactamase Inhibitor Combinations			Cephems			Folate Pathway Inhibitors		Penicillins		Phenicol		Quinolones		Tetracyclines
			0	1	2-3	4-5	6-7	8	AMI	GEN	KAN	STR	AMC	FOX	TIO	AXO	FIS	COT	AMP	CHL	CIP	NAL	TET				
			Number of Isolates																								
Hadar	40	27.0%	6	31	3		6	6	30					7		17										36	
Saintpaul	16	10.8%	3	9	4		1	1						1		3										13	
III 18:z4,z23:-	14	9.5%	13			1		1	1	1			1	1	1	1		1		1					1		
Schwarzengrund	9	6.1%	4	3	2									2											5		
Heidelberg	8	5.4%	2	4	2		4	4	3		1	1	1	1	3		4		1						7		
Newport	8	5.4%	1	2	3	1	1	2	3	2		2	2	2	3		2		1						5		
Agona	6	4.1%	1	1	2	2	1	1	1		1	1	1	1	3	1	3								4		
Senftenberg	6	4.1%	2	1	3		2		1		2	2	2	2			3										
Worthington	6	4.1%	2	4																					4		
Other	35	23.6%	6	8	16	5	9	5	11		1	1	1	1	16		15		1			1			20		
Total	148	100.0%	32	36	65	13	2	25	21	48	8	8	8	8	36	2	48	4	1	1	1	1	1	1	95		

¹ AMI= Amikacin, GEN= Gentamicin, KAN= Kanamycin, STR= Streptomycin, AMC= Amoxicillin/Clavulanic Acid, FOX= Cefoxitin, TIO= Ceftiofur, AXO= Ceftriaxone, FIS= Sulfisoxazole
COT= Trimethoprim/Sulfamethoxazole, AMP= Ampicillin, CHL= Chloramphenicol, CIP= Ciprofloxacin, NAL= Nalidixic Acid, TET= Tetracycline

Table 20. Number of Resistant Non-Typhoidal *Salmonella* Isolates from Cattle, by Serotype, 2008

<i>Salmonella</i> Serotype	No. of Isolates	% of Isolates	Number of Resistant Isolates by Antimicrobial Agent ¹ and Class																								
			Number of Antimicrobial Classes in Resistance Pattern						Aminoglycosides				β-Lactam/β-Lactamase Inhibitor Combinations			Cephems			Folate Pathway Inhibitors		Penicillins		Phenicol		Quinolones		Tetracyclines
			0	1	2-3	4-5	6-7	8	AMI	GEN	KAN	STR	AMC	FOX	TIO	AXO	FIS	COT	AMP	CHL	CIP	NAL	TET				
			Number of Isolates																								
Montevideo	104	23.5%	96	6	1	1			1					2	1	1		1							8		
Dublin	53	12.0%	7	3	14	28	1	6	31	42		30		25	30	29	45	7	39		40		1		43		
Anatum	35	7.9%	30	5																					5		
Newport	31	7.0%	8		3	20				23		20	20	20	23	4	23		20						23		
Typhimurium	28	6.3%	13		2	7	6	4	14		6	5	6	6	15		14		10						14		
Cerro	27	6.1%	25	1		1				1		1	1	1	1		1		1						2		
Kentucky	22	5.0%	18	4						1															3		
Muenster	18	4.1%	17		1					1					1										1		
Agona	17	3.8%	2	1	6	7	1		6	10		8	8	8	8	14	5	8		8			1		15		
Mbandaka	17	3.8%	17																								
Meleagridis	17	3.8%	17																								
Other	74	16.7%	55	7	4	2	5	1	1	3	9	8	6	7	7	9	3	10		7			1		16		
Total	443	100.0%	305	24	17	27	67	3	7	44	102	73	65	72	71	110	20	96	87	3	1	1	1	1	130		

¹ AMI= Amikacin, GEN= Gentamicin, KAN= Kanamycin, STR= Streptomycin, AMC= Amoxicillin/Clavulanic Acid, FOX= Cefoxitin, TIO= Ceftiofur, AXO= Ceftriaxone, FIS= Sulfisoxazole
COT= Trimethoprim/Sulfamethoxazole, AMP= Ampicillin, CHL= Chloramphenicol, CIP= Ciprofloxacin, NAL= Nalidixic Acid, TET= Tetracycline

Table 21. Number of Resistant Non-Typhoidal *Salmonella* Isolates from Swine, by Serotype, 2008

<i>Salmonella</i> Serotype	No. of Isolates	% of Isolates	Number of Resistant Isolates by Antimicrobial Agent ¹ and Class																																	
			Number of Antimicrobial Classes in Resistance Pattern						Aminoglycosides		β-Lactam/β-Lactamase Inhibitor Combinations	Cephems			Folate Pathway Inhibitors		Penicillins		Phenicol		Quinolones		Tetracyclines													
			0	1	2-3	4-5	6-7	8	AMI	GEN	KAN	STR	AMC	FOX	TIO	AXO	FIS	COT	AMP	CHL	CIP	NAL	TET													
Derby	25	22.5%	2	5	15	1	2			1	18				2			2	2	2		18	1		2		3								23	
Infantis	15	13.5%	15																																	
Typhimurium	10	9.0%		1	2	7				1	1	8									8	1		7			5								10	
Agona	6	5.4%	1		3	2				1	1				1			1	1	1		4	1		2										5	
Anatum	6	5.4%	1	4	1										1			1	1	1					1										4	
London	6	5.4%	3	2	1							1																							3	
Saintpaul	6	5.4%	6																																	
Johannesburg	5	4.5%	3	2																															2	
Ohio	4	3.6%	4																																	
Hadar	3	2.7%		3																															3	
Other	25	23.4%	18		3	3	1			1	1	6			1			1	1	1		5		4		3									7	
Total	111	100.0%	53	17	25	13	3			3	4	33			5			5	5	5		35	3	16		11								57		

¹ AMI= Amikacin, GEN= Gentamicin, KAN= Kanamycin, STR= Streptomycin, AMC= Amoxicillin/Clavulanic Acid, FOX= Cefoxitin, TIO= Ceftiofur, AXO= Ceftriaxone, FIS= Sulfisoxazole
 COT= Trimethoprim/Sulfamethoxazole, AMP= Ampicillin, CHL= Chloramphenicol, CIP= Ciprofloxacin, NAL= Nalidixic Acid, TET= Tetracycline

Multidrug Resistance

Table 22a. Resistance Patterns among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2379
	Chicken Breasts						60	83	157	153	152	99	199
	Ground Turkey						74	114	142	183	159	190	245
	Ground Beef						9	10	14	8	19	13	24
	Pork Chops						10	5	11	9	8	18	23
	Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624
	Turkeys	107	240	713	518	550	244	262	236	227	304	271	148
	Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443
	Swine	111	793	876	451	418	379	211	308	301	304	211	111
Resistance Pattern	Isolate Source												
1. No Resistance Detected	Humans	68.4% 887	72.9% 1060	74.1% 1107	74.5% 1022	72.5% 1022	79.1% 1580	78.0% 1447	80.0% 1425	80.9% 1646	80.5% 1749	81.1% 1738	84.0% 1999
	Chicken Breasts						51.7% 31	45.8% 38	40.1% 63	46.4% 71	38.8% 59	47.5% 47	45.7% 91
	Ground Turkey						37.8% 28	34.2% 39	28.9% 41	30.1% 55	17.6% 28	15.3% 29	20.8% 51
	Ground Beef						77.8% 7	60.0% 6	78.6% 11	75.0% 6	73.7% 14	92.3% 12	79.2% 19
	Pork Chops						20.0% 2	20.0% 1	45.5% 5	44.4% 4	25.0% 2	44.4% 8	65.2% 15
	Chickens	52.8% 113	58.6% 329	58.8% 846	56.9% 668	66.6% 871	62.0% 930	61.1% 708	62.7% 803	61.2% 1217	57.2% 790	53.9% 536	60.4% 377
	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	27.8% 63	28.0% 85	15.5% 42	21.6% 32
	Cattle	66.7% 16	73.2% 208	74.5% 1200	70.0% 972	69.9% 624	64.3% 648	61.0% 409	65.6% 398	63.2% 208	67.6% 263	72.0% 316	68.8% 305
	Swine	44.1% 49	49.2% 390	48.9% 428	43.2% 195	43.5% 182	40.1% 152	53.6% 113	37.3% 115	44.5% 134	34.5% 105	43.1% 91	47.7% 53
2. Resistant to ≥ 3 Antimicrobial Classes	Humans	17.2% 223	16.3% 237	14.7% 220	15.6% 214	16.7% 236	12.3% 245	14.2% 263	11.4% 204	12.0% 244	11.8% 256	11.1% 239	9.4% 223
	Chicken Breasts						20.0% 12	30.1% 25	34.4% 54	25.5% 39	24.3% 37	25.3% 25	38.2% 76
	Ground Turkey						21.6% 16	31.6% 36	26.1% 37	29.0% 53	24.5% 39	42.6% 81	51.0% 125
	Ground Beef						22.2% 2	40.0% 4	14.3% 2	25.0% 2	10.5% 2	0.0% 0	20.8% 5
	Pork Chops						60.0% 6	40.0% 2	18.2% 2	22.2% 2	25.0% 2	5.6% 1	17.4% 4
	Chickens	9.8% 21	13.4% 75	12.3% 177	15.1% 177	10.2% 133	14.2% 213	13.5% 156	15.8% 202	15.1% 301	16.4% 226	17.8% 177	11.4% 71
	Turkeys	25.2% 27	23.8% 57	26.2% 187	21.6% 112	30.4% 167	24.2% 59	21.8% 57	27.1% 64	28.2% 64	27.3% 83	33.6% 91	29.7% 44
	Cattle	12.5% 3	13.7% 39	13.3% 214	19.8% 275	18.9% 169	24.5% 247	29.6% 198	21.1% 128	27.7% 91	23.9% 93	22.1% 97	23.5% 104
	Swine	26.1% 29	24.0% 190	26.4% 231	34.6% 156	30.6% 128	34.0% 129	23.7% 50	33.4% 103	31.9% 96	22.7% 69	28.0% 59	29.7% 33
3. Resistant to ≥ 4 Antimicrobial Classes	Humans	13.0% 169	12.8% 186	11.9% 177	12.7% 174	13.5% 191	9.8% 195	11.4% 211	9.2% 164	9.1% 185	8.1% 177	8.2% 176	7.4% 176
	Chicken Breasts						5.0% 3	16.9% 14	24.2% 38	18.3% 28	15.1% 23	13.1% 13	23.1% 46
	Ground Turkey						13.5% 10	24.6% 28	12.7% 18	7.7% 14	8.2% 13	14.7% 28	15.1% 37
	Ground Beef						22.2% 2	40.0% 4	14.3% 2	12.5% 1	5.3% 1	0.0% 0	12.5% 3
	Pork Chops						40.0% 4	40.0% 2	18.2% 2	22.2% 2	25.0% 2	5.6% 1	13.0% 3
	Chickens	3.3% 7	3.9% 22	4.9% 71	6.7% 79	3.6% 47	7.7% 115	6.8% 79	9.8% 126	8.7% 174	10.3% 142	12.3% 122	7.5% 47
	Turkeys	5.6% 6	6.3% 15	10.8% 77	10.0% 52	14.7% 81	11.1% 27	9.5% 25	10.2% 24	11.5% 26	12.2% 37	15.1% 41	10.1% 15
	Cattle	8.3% 2	9.2% 26	10.9% 175	17.4% 242	16.9% 151	22.1% 223	27.5% 184	18.8% 114	24.9% 82	22.1% 86	21.0% 92	21.9% 97
	Swine	15.3% 17	11.2% 89	9.8% 86	17.1% 77	9.1% 38	12.7% 48	10.9% 23	15.3% 47	13.3% 40	9.9% 30	17.5% 37	14.4% 16
4. Resistant to ≥ 5 Antimicrobial Classes	Humans	9.8% 128	9.8% 142	8.5% 127	9.5% 131	10.3% 145	8.2% 164	9.8% 182	7.9% 141	7.2% 146	6.3% 137	6.9% 149	6.6% 156
	Chicken Breasts						3.3% 2	13.3% 11	22.3% 35	17.7% 27	14.5% 22	12.1% 12	19.1% 38
	Ground Turkey						12.2% 9	14.0% 16	4.9% 7	2.7% 5	3.1% 5	3.2% 6	2.9% 7
	Ground Beef						22.2% 2	40.0% 4	14.3% 2	12.5% 1	5.3% 1	0.0% 0	12.5% 3
	Pork Chops						40.0% 4	40.0% 2	9.1% 1	22.2% 2	0.0% 0	0.0% 0	0.0% 0
	Chickens	1.4% 3	2.7% 15	3.0% 43	5.5% 64	3.1% 41	5.7% 85	4.9% 57	8.0% 103	5.9% 117	6.6% 91	7.4% 74	6.1% 38
	Turkeys	4.7% 5	0.8% 2	5.0% 36	4.8% 25	6.0% 33	6.6% 16	3.1% 8	5.5% 13	6.2% 14	5.9% 18	7.0% 19	4.1% 6
	Cattle	8.3% 2	4.6% 13	8.0% 128	14.0% 195	15.1% 135	19.3% 195	23.6% 158	17.8% 108	23.1% 76	20.1% 78	18.9% 83	19.0% 84
	Swine	4.5% 5	8.1% 64	7.3% 64	9.3% 42	7.2% 30	9.0% 34	9.5% 20	12.3% 38	10.3% 31	5.9% 18	11.4% 24	8.1% 9

Table 22b. Resistance Patterns among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2379
	Chicken Breasts						60	83	157	153	152	99	199
	Ground Turkey						74	114	142	183	159	190	245
	Ground Beef						9	10	14	8	19	13	24
	Pork Chops						10	5	11	9	8	18	23
	Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624
	Turkeys	107	240	713	518	550	244	262	236	227	304	271	148
	Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443
	Swine	111	793	876	451	418	379	211	308	301	304	211	111
	Resistance Pattern	Isolate Source											
5. At Least ACSSuT¹ Resistant	Humans	9.5% 123	8.9% 130	8.4% 125	8.9% 122	10.1% 142	7.8% 156	9.3% 173	7.2% 128	6.9% 141	5.6% 121	6.3% 136	5.8% 137
	Chicken Breasts						0.0% 0	2.4% 2	1.9% 3	0.7% 1	2.6% 4	0.0% 0	0.5% 1
	Ground Turkey						1.4% 1	0.9% 1	2.8% 4	0.5% 1	0.6% 1	1.6% 3	1.6% 4
	Ground Beef						22.2% 2	40.0% 4	14.3% 2	12.5% 1	5.3% 1	0.0% 0	12.5% 3
	Pork Chops						40.0% 4	40.0% 2	9.1% 1	22.2% 2	0.0% 0	0.0% 0	0.0% 0
	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	1.6% 31	1.6% 22	1.5% 15	1.4% 9
	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	4.0% 9	3.9% 12	4.8% 13	2.0% 3
	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	20.4% 67	18.3% 71	16.2% 71	18.1% 80
	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	9.6% 29	5.3% 16	10.9% 23	8.1% 9
	6. At Least ACT/S² Resistant	Humans	0.4% 5	0.9% 13	0.9% 14	0.9% 13	0.5% 7	1.1% 21	1.2% 23	0.6% 10	0.9% 18	0.7% 15	0.7% 16
Chicken Breasts							0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Ground Turkey							1.4% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Ground Beef							0.0% 0	0.0% 0	7.1% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Pork Chops							20.0% 2	0.0% 0	0.0% 0	11.1% 1	0.0% 0	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	0.1% 2	0.0% 0	0.0% 0	0.2% 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	0.0% 0	0.3% 1	0.0% 0	0.7% 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	4.3% 14	4.1% 16	2.5% 11	3.8% 17
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	1.7% 5	0.3% 1	1.9% 4	0.9% 1
7. At Least ACSSuTAuCf³ Resistant		Humans	0.3% 4	0.3% 5	1.5% 23	2.6% 36	2.6% 36	3.4% 67	3.2% 60	2.4% 42	2.0% 41	2.0% 43	2.1% 46
	Chicken Breasts						0.0% 0	0.0% 0	1.9% 3	0.0% 0	2.6% 4	0.0% 0	0.0% 0
	Ground Turkey						1.4% 1	0.9% 1	2.1% 3	0.5% 1	0.0% 0	1.1% 2	1.2% 3
	Ground Beef						22.2% 2	40.0% 4	14.3% 2	0.0% 0	0.0% 0	0.0% 0	8.3% 2
	Pork Chops						20.0% 2	20.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	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	0.9% 18	1.1% 15	1.4% 14	1.1% 7
	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	1.8% 4	2.3% 7	4.1% 11	0.7% 1
	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	17.6% 58	16.2% 63	13.7% 60	14.9% 66
	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	2.7% 8	1.0% 3	0.5% 1	2.7% 3
	8. At Least Ceftiofur and Nalidixic Acid Resistant	Humans	0.2% 2	0.0% 0	0.1% 1	0.1% 1	0.1% 2	0.2% 4	0.1% 2	0.1% 2	0.1% 2	0.1% 3	0.2% 5
Chicken Breasts							0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Ground Turkey							0.0% 0	0.9% 1	0.0% 0	0.0% 0	0.0% 0	0.5% 1	0.0% 0
Ground Beef							0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Pork Chops							0.0% 0	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	0.1% 1	0.1% 1	0.0% 0	0.6% 9	0.1% 1	0.2% 3	0.1% 1	0.0% 0	0.0% 0	0.0% 0
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	0.9% 2	0.3% 1	0.7% 2	0.0% 0
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	0.9% 3	0.3% 1	0.2% 1	0.7% 3
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	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

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

Table 23. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are Resistant to ≥ 3 Antimicrobial Classes, by Serotype, 2008

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (N=223)	Typhimurium	110	49.3	Chicken Breasts (N=76)	Typhimurium	54	71.1	Chickens (N=71)	Kentucky	29	40.8
	Newport	34	15.2		Heidelberg	11	14.5		Typhimurium	22	31.0
	Heidelberg	21	9.4		Kentucky	8	10.5		Heidelberg	12	16.9
	I 4,[5],12:i:-	8	3.6		Derby	1	1.3		I 4,[5],12:i:-	2	2.8
	Agona	7	3.1		Enteritidis	1	1.3		I 4,[5],12:r:-	2	2.8
	Dublin	5	2.2		Hadar	1	1.3		Braenderup	1	1.4
	Hadar	4	1.8						Enteritidis	1	1.4
	Saintpaul	4	1.8				Newport	1	1.4		
	Concord	3	1.3				Orion	1	1.4		
	Anatum	2	0.9								
	Derby	2	0.9	Ground Turkey (N=125)	Hadar	47	37.6	Turkeys (N=44)	Hadar	16	36.4
	Infantis	2	0.9		Heidelberg	47	37.6		Heidelberg	4	9.1
	Stanley	2	0.9		Saintpaul	9	7.2		Newport	3	6.8
	Chester	1	0.4		Derby	4	3.2		Agona	2	4.5
	Choleraesuis	1	0.4		Anatum	3	2.4		Albany	2	4.5
	Corvallis	1	0.4		Agona	2	1.6		Berta	2	4.5
	Enteritidis	1	0.4		Brandenburg	2	1.6		Muenster	2	4.5
	Hato	1	0.4		Senftenberg	2	1.6		Saintpaul	2	4.5
	Javiana	1	0.4		Alachua	1	0.8		Senftenberg	2	4.5
	Kentucky	1	0.4		Albany	1	0.8		Anatum	1	2.3
	Muenster	1	0.4	Berta	1	0.8	Brandenburg	1	2.3		
	Norwich	1	0.4	I 4,12:d:-	1	0.8	I 3,10:e,h:-	1	2.3		
	Paratyphi B Var. L(+) tartrate+	1	0.4	I 4,5,12:r:-	1	0.8	I 4,12:l,v:-	1	2.3		
Senftenberg	1	0.4	IIIa 18:z4,z23:-	1	0.8	I 4,5,12:r:-	1	2.3			
Tennessee	1	0.4	Muenster	1	0.8	III 18:z4,z23:-	1	2.3			
Other	1	0.4	Schwarzengrund	1	0.8	Minnesota	1	2.3			
Partially serotyped	2	0.9	Typhimurium	1	0.8	Rough O:r:1,2	1	2.3			
Rough/Nonmotile isolates	3	1.3				Typhimurium	1	2.3			
Unknown	1	0.4									
				Ground Beef (N=5)	Newport	2	40.0	Cattle (N=104)	Dublin	45	43.3
			Heidelberg		1	20.0	Newport		23	22.1	
			Saintpaul		1	20.0	Typhimurium		14	13.5	
			Typhimurium		1	20.0	Agona		10	9.6	
						Heidelberg	2		1.9		
						I 9,12:-:-	2		1.9		
						Reading	2		1.9		
						Cerro	1		1.0		
						Give	1		1.0		
						Montevideo	1		1.0		
						Muenster	1	1.0			
						Uganda	1	1.0			
						Untypable	1	1.0			
				Pork Chops (N=4)	Adelaide	3	75.0	Swine (N=33)	Derby	18	54.5
			Typhimurium		1	25.0	Typhimurium		8	24.2	
						Agona	2		6.1		
						Anatum	1		3.0		
						Choleraesuis	1		3.0		
						Heidelberg	1		3.0		
						I 4,5,12:i:-	1	3.0			
						Newport	1	3.0			

Table 24. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are Resistant to ≥ 4 Antimicrobial Classes, by Serotype, 2008

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (N=176)	Typhimurium	98	55.7	Chicken Breasts (N=46)	Typhimurium	38	82.6	Chickens (N=47)	Kentucky	21	44.7
	Newport	34	19.3		Heidelberg	4	8.7		Typhimurium	18	38.3
	Heidelberg	10	5.7		Kentucky	4	8.7		Heidelberg	4	8.5
	I 4,[5],12:i:-	6	3.4						Enteritidis	1	2.1
	Dublin	5	2.8				Orion	1	2.1		
	Agona	4	2.3				I 4,5,12:r:-	1	2.1		
	Concord	3	1.7				Newport	1	2.1		
	Anatum	2	1.1								
	Chester	1	0.6								
	Hadar	1	0.6	Ground Turkey (N=37)	Hadar	13	35.1	Turkeys (N=15)	Hadar	3	20.0
	Hato	1	0.6		Heidelberg	11	29.7		Agona	2	13.3
	Infantis	1	0.6		Anatum	3	8.1		Heidelberg	2	13.3
	Kentucky	1	0.6		Senftenberg	2	5.4		Newport	2	13.3
	Paratyphi B Var. L(+) tartrate+	1	0.6		Agona	1	2.7		Anatum	1	6.7
	Saintpaul	1	0.6		Alachua	1	2.7		I 3,10:e,h:-	1	6.7
	Senftenberg	1	0.6		Derby	1	2.7		I 4,12:l,v:-	1	6.7
	Stanley	1	0.6		I 4,5,12:r:-	1	2.7		III 18:z4,z23:-	1	6.7
	Tennessee	1	0.6		IIIa 18:z4,z23:-	1	2.7		Rough O:r:1,2	1	6.7
	Partially serotyped	2	1.1		Muenster	1	2.7		Typhimurium	1	6.7
	Rough/Nonmotile isolates	1	0.6	Saintpaul	1	2.7					
Unknown	1	0.6	Typhimurium	1	2.7						
				Ground Beef (N=3)	Newport	2	66.7	Cattle (N=97)	Dublin	43	44.3
					Typhimurium	1	33.3		Newport	23	23.7
							Typhimurium		13	13.4	
							Agona		8	8.2	
							I 9,12:-:-		2	2.1	
							Reading		2	2.1	
							Cerro		1	1.0	
							Give		1	1.0	
							Heidelberg		1	1.0	
							Montevideo		1	1.0	
							Uganda	1	1.0		
							Untypable	1	1.0		
				Pork Chops (N=3)	Adelaide	3	100.0	Swine (N=16)	Typhimurium	7	43.8
									Derby	3	18.8
							Agona		2	12.5	
							Choleraesuis		1	6.3	
							Heidelberg		1	6.3	
							I 4,5,12:i:-		1	6.3	
							Newport	1	6.3		

Table 25. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are Resistant to ≥ 5 Antimicrobial Classes, by Serotype, 2008

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (N=156)	Typhimurium	94	60.3	Chicken Breasts (N=38)	Typhimurium	33	86.8	Chickens (N=38)	Typhimurium	16	42.1
	Newport	32	20.5		Kentucky	3	7.9		Kentucky	15	39.5
	Dublin	5	3.2		Heidelberg	2	5.3		Heidelberg	4	10.5
	Heidelberg	5	3.2				Enteritidis		1	2.6	
	Agona	4	2.6				I 4,5,12:r:-		1	2.6	
	I 4,[5],12:l:-	4	2.6				Newport	1	2.6		
	Concord	3	1.9	Ground Turkey (N=7)	Senftenberg	2	28.6	Turkeys (N=6)	Heidelberg	2	33.3
	Anatum	1	0.6		Agona	1	14.3		Agona	1	16.7
	Hato	1	0.6		Alachua	1	14.3		III 18:z4,z23:-	1	16.7
	Infantis	1	0.6		Heidelberg	1	14.3		Newport	1	16.7
	Kentucky	1	0.6		IIIa 18:z4,z23:-	1	14.3		Typhimurium	1	16.7
	Paratyphi B Var. L(+) tartrate+	1	0.6		Typhimurium	1	14.3				
	Saintpaul	1	0.6								
	Partially serotyped	2	1.3	Ground Beef (N=3)	Newport	2	66.7	Cattle (N=84)	Dublin	37	44.0
	Rough/Nonmotile isolates	1	0.6		Typhimurium	1	33.3		Newport	20	23.8
									Typhimurium	10	11.9
							Agona		8	9.5	
						I 9,12:-:-	2		2.4		
						Reading	2		2.4		
						Cerro	1		1.2		
						Give	1		1.2		
						Montevideo	1		1.2		
						Uganda	1		1.2		
						Untypable	1	1.2			
				Pork Chops (N=0)			Swine (N=9)	Typhimurium	4	44.4	
								Derby	2	22.2	
								Heidelberg	1	11.1	
								I 4,5,12:i:-	1	11.1	
								Newport	1	11.1	

Table 26. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are at least ACSSuT¹ Resistant, by Serotype, 2008

Humans				Retail Meats				Food Animals				
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%	
Humans (N=137)	Typhimurium	91	66.4	Chicken Breasts (N=1)	Heidelberg	1	100.0	Chickens (N=9)	Heidelberg	4	44.4	
	Newport	29	21.2						Kentucky	4	44.4	
	Dublin	4	2.9						Newport	1	11.1	
	I 4,[5],12:l:-	3	2.2	Ground Turkey (N=4)	Agona	1	25.0	Turkeys (N=3)	Heidelberg	1	33.3	
	Concord	2	1.5		IIIa 18:z4,z23:-	1	25.0		III 18:z4,z23:-	1	33.3	
	Anatum	1	0.7		Senftenberg	1	25.0		Typhimurium	1	33.3	
	Heidelberg	1	0.7		Typhimurium	1	25.0					
	Infantis	1	0.7									
	Paratyphi B Var. L(+) tartrate+	1	0.7		Ground Beef (N=3)	Newport	2	66.7	Cattle (N=80)	Dublin	33	41.3
	Saintpaul	1	0.7			Typhimurium	1	33.3		Newport	20	25.0
	Partially serotyped	2	1.5					Typhimurium		10	12.5	
	Rough/Nonmotile isolates	1	0.7				Agona	8		10.0		
							I 9,12:-:-	2		2.5		
							Reading	2		2.5		
							Cerro	1		1.3		
							Give	1		1.3		
							Montevideo	1		1.3		
						Uganda	1	1.3				
						Untypable	1	1.3				
				Pork Chops (N=0)			Swine (N=9)	Typhimurium	4	44.4		
								Derby	2	22.2		
								Heidelberg	1	11.1		
								I 4,5,12:i:-	1	11.1		
								Newport	1	11.1		

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

Table 27. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are at least ACT/S¹ Resistant, by Serotype, 2008

Humans				Retail Meats				Food Animals					
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%		
Humans (N=11)	Newport	7	63.6	Chicken Breasts (N=0)				Chickens (N=1)	Newport	1	100.0		
	Concord	2	18.2										
	Typhimurium	2	18.2		Ground Turkey (N=0)				Turkeys (N=1)	III 18:z4,z23:-	1	100.0	
Humans (N=11)				Ground Beef (N=0)				Cattle (n=17)	Agona	5	29.4		
										Dublin	5	29.4	
											Newport	4	23.5
											I 9,12:-:-	2	11.8
											Give	1	5.9
				Pork Chops (N=0)				Swine (N=1)	Derby	1	100.0		

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

Table 28. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are at least ACSSuTAuCf¹ Resistant, by Serotype, 2008

Humans				Retail Meats				Food Animals					
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%		
Humans (N=43)	Newport	29	67.4	Chicken Breasts (N=0)				Chickens (N=7)	Kentucky	4	57.1		
	Typhimurium	8	18.6							Heidelberg	2	28.6	
	Dublin	2	4.7							Newport	1	14.3	
	I 4,[5],12:l:-	2	4.7		Ground Turkey (N=3)	Agona	1	33.3	Turkeys (N=1)	III 18:z4,z23:-	1	100.0	
	Saintpaul	1	2.3				Senftenberg	1					33.3
	Partially serotyped	1	2.3				Typhimurium	1					33.3
				Ground Beef (N=2)	Newport	2	100.0	Cattle (N=66)	Dublin	25	37.9		
										Newport	20	30.3	
										Agona	8	12.1	
										Typhimurium	6	9.1	
										I 9,12:-:-	2	3.0	
				Pork Chops (N=0)				Swine (N=3)	Reading	2	3.0		
										Cerro	1	1.5	
										Give	1	1.5	
									Uganda	1	1.5		
									Derby	2	66.7		
									Newport	1	33.3		

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

Table 29. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are at least Ceftiofur and Nalidixic Acid Resistant, by Serotype, 2008

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (N=0)				Chicken Breasts (N=0)				Chickens (N=0)			
				Ground Turkey (N=0)				Turkeys (N=0)			
				Ground Beef (N=0)				Cattle (N=3)	Agona	1	33.3
									Dublin	1	33.3
								Uganda	1	33.3	
				Pork Chops (N=0)				Swine (N=0)			

E. Antimicrobial Susceptibility among *Salmonella* Enteritidis

Table 30a. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	301	244	269	319	277	337	257	271	384	413	385	439	
	Chicken Breasts						4	3	3	12	17	13	30	
	Ground Turkey						5	1	0	0	0	0	1	
	Ground Beef						1	1	0	0	0	0	1	
	Pork Chops						0	0	0	0	0	0	0	
	Chickens	1	13	41	31	21	48	42	84	173	188	124	116	
	Turkeys	0	0	1	1	0	0	0	0	0	3	0	1	
	Cattle	1	1	8	4	4	6	3	2	2	2	4	5	
	Swine	0	0	2	1	1	1	1	1	1	0	0	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%	0.0%	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%		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%	
		Gentamicin (MIC ≥ 16 µg/ml)	Humans	0.3%	0.4%	0.0%	0.3%	0.0%	0.3%	0.4%	0.4%	0.8%	0.2%	0.0%
	Chicken Breasts							0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%
	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%	1.2%	0.0%	0.0%	0.0%	0.0%
	Turkeys				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%	
	Kanamycin (MIC ≥ 64 µg/ml)		Humans	0.7%	0.4%	0.4%	0.3%	0.7%	0.3%	0.0%	0.7%	0.3%	0.2%	0.5%
		Chicken Breasts						0.0%	0.0%	0.0%	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%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Turkeys			0.0%	0.0%						0.0%		0.0%
		Cattle	0.0%	0.0%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%
		Swine			0.0%	0.0%	100.0%	0.0%	0.0%	0.0%			0.0%	
		Streptomycin (MIC ≥ 64 µg/ml)	Humans	4.3%	1.6%	2.2%	0.0%	1.4%	1.5%	1.2%	2.2%	1.0%	1.2%	0.5%
	Chicken Breasts							0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%
	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%	2.1%	0.0%	1.2%	0.6%	0.0%	0.8%	0.0%
	Turkeys				0.0%	0.0%						0.0%		0.0%
	Cattle		0.0%	0.0%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%
	Swine				0.0%	0.0%	100.0%	0.0%	0.0%	0.0%			0.0%	

Table 30b. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	301	244	269	319	277	337	257	271	384	413	385	439	
	Chicken Breasts						4	3	3	12	17	13	30	
	Ground Turkey						5	1	0	0	0	0	1	
	Ground Beef						1	1	0	0	0	0	1	
	Pork Chops						0	0	0	0	0	0	0	
	Chickens	1	13	41	31	21	48	42	84	173	188	124	116	
	Turkeys	0	0	1	1	0	0	0	0	0	3	0	1	
	Cattle	1	1	8	4	4	6	3	2	2	2	4	5	
	Swine	0	0	2	1	1	1	1	1	1	0	0	1	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	0.0%	0.0%	0.4%	0.0%	1.4%	0.6%	0.0%	0.0%	0.8%	0.5%	0.5%	0.0%
		Chicken Breasts	0	0	1	0	4	2	0	0	3	2	2	0
		Ground Turkey						0.0%	33.3%	33.3%	0.0%	0.0%	0.0%	0.0%
		Ground Beef						0	1	1	0	0	0	0
		Pork Chops						0.0%	0.0%					0.0%
		Chickens	0.0%	0.0%	2.4%	3.2%	0.0%	4.2%	0.0%	1.2%	0.6%	0.0%	0.0%	0.9%
		Turkeys	0	0	1	1	0	2	0	1	1	0	0	1
		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
Cephems	Cefoxitin (MIC ≥ 32 µg/ml)	Humans				0.0%	0.4%	0.0%	0.0%	0.0%	1.0%	0.5%	0.3%	0.0%
		Chicken Breasts				0	1	0	0	0	4	2	1	0
		Ground Turkey						0.0%	33.3%	33.3%	0.0%	0.0%	0.0%	0.0%
		Ground Beef						0	0					0.0%
		Pork Chops						0	0					0
		Chickens				0.0%	0.0%	2.1%	0.0%	1.2%	0.6%	0.0%	0.0%	0.9%
		Turkeys				0	0	1	0	1	1	0	0	1
		Cattle				0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%
		Swine				0	0	0	0	0	0	1	0	0
	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	0.3%	0.0%	0.4%	0.0%	2.2%	0.0%	0.0%	0.0%	0.5%	0.5%	0.3%	0.0%
		Chicken Breasts	1	0	1	0	6	0	0	0	2	2	1	0
		Ground Turkey						0.0%	33.3%	33.3%	0.0%	0.0%	0.0%	0.0%
		Ground Beef						0	0					0.0%
		Pork Chops						0	0					0
		Chickens	0.0%	0.0%	4.9%	3.2%	0.0%	4.2%	0.0%	1.2%	1.2%	0.0%	0.0%	0.9%
		Turkeys	0	0	2	1	0	2	0	1	2	0	0	1
		Cattle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%
		Swine	0	0	0	0	0	0	0	0	0	1	0	0
	Ceftriaxone (MIC ≥ 4 µg/ml) ¹	Humans	0.3%	0.0%	0.4%	0.0%	1.4%	0.0%	0.0%	0.0%	0.3%	0.5%	0.3%	0.0%
		Chicken Breasts	1	0	1	0	4	0	0	0	1	2	1	0
		Ground Turkey						0.0%	33.3%	33.3%	0.0%	0.0%	0.0%	0.0%
		Ground Beef						0	0					0.0%
		Pork Chops						0	0					0
		Chickens	0.0%	0.0%	2.4%	3.2%	0.0%	4.2%	0.0%	1.2%	0.6%	0.0%	0.0%	0.9%
		Turkeys	0	0	1	1	0	2	0	1	1	0	0	1
		Cattle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%
		Swine	0	0	0	0	0	0	0	0	0	1	0	0
Humans							0.0%	33.3%	33.3%	0.0%	0.0%	0.0%	0.0%	
Chicken Breasts							0	1	1	0	0	0	0	
Ground Turkey							0	0					0.0%	
Ground Beef							0	0					0	
Pork Chops														
Chickens		0.0%	0.0%	2.4%	3.2%	0.0%	4.2%	0.0%	1.2%	0.6%	0.0%	0.0%	0.9%	
Turkeys		0	0	1	1	0	2	0	1	1	0	0	1	
Cattle		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	
Swine		0	0	0	0	0	0	0	0	0	1	0	0	

¹ Breakpoints for ceftriaxone were revised to reflect those published in CLSI document M100-S20

Table 30c. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	301	244	269	319	277	337	257	271	384	413	385	439	
	Chicken Breasts						4	3	3	12	17	13	30	
	Ground Turkey						5	1	0	0	0	0	1	
	Ground Beef						1	1	0	0	0	0	1	
	Pork Chops						0	0	0	0	0	0	0	
	Chickens	1	13	41	31	21	48	42	84	173	188	124	116	
	Turkeys	0	0	1	1	0	0	0	0	0	3	0	1	
	Cattle	1	1	8	4	4	6	3	2	2	2	4	5	
	Swine	0	0	2	1	1	1	1	1	1	0	0	1	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole ¹ (MIC ≥ 512 µg/ml)	Humans	9.0%	2.0%	3.0%	0.9%	2.2%	1.5%	1.2%	1.8%	1.6%	1.5%	1.6%	1.1%
		Chicken Breasts	27	5	8	3	6	5	3	5	6	6	6	5
		Ground Turkey						0.0%	0.0%	33.3%	0.0%	0.0%	0.0%	3.3%
		Ground Beef						0	0	1	0	0	0	1
		Pork Chops						0	0					0
		Chickens	0.0%	0.0%	4.9%	3.2%	0.0%	4.2%	2.4%	1.2%	0.0%	0.0%	0.8%	0.9%
		Turkeys	0	0	2	1	0	2	1	1	0	0	1	1
		Cattle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%
		Swine	0	0	0	0	0	0	0	0	0	1	0	0
	Trimethoprim-Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	1.3%	0.8%	0.7%	0.0%	0.7%	0.6%	0.8%	0.0%	0.5%	0.5%	1.0%	0.9%
		Chicken Breasts	4	2	2	0	2	2	2	0	2	2	4	4
		Ground Turkey						0.0%	0.0%	0.0%	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%	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
		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
Penicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	11.3%	6.1%	10.8%	7.5%	8.7%	6.8%	2.3%	4.1%	2.9%	4.4%	2.1%	3.6%
		Chicken Breasts	34	15	29	24	24	23	6	11	11	18	8	16
		Ground Turkey						0.0%	66.7%	33.3%	0.0%	17.6%	0.0%	6.7%
		Ground Beef						0	2	1	0	3	0	2
		Pork Chops						0	0					0
		Chickens	100.0%	30.8%	12.2%	9.7%	0.0%	4.2%	0.0%	1.2%	1.2%	1.6%	1.6%	2.6%
		Turkeys	1	4	5	3	0	2	0	1	2	3	2	3
		Cattle	0.0%	100.0%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%
		Swine	0	1	1	0	0	0	0	0	0	1	0	0
Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	0.7%	0.0%	0.4%	0.0%	0.0%	0.3%	0.4%	0.4%	0.5%	0.0%	0.5%	0.5%
		Chicken Breasts	2	0	1	0	0	1	1	1	2	0	2	2
		Ground Turkey						0.0%	0.0%	0.0%	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%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%
		Turkeys	0	0	0	0	0	0	0	0	1	0	0	0
		Cattle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%
		Swine	0	0	0	0	0	0	0	0	0	1	0	0

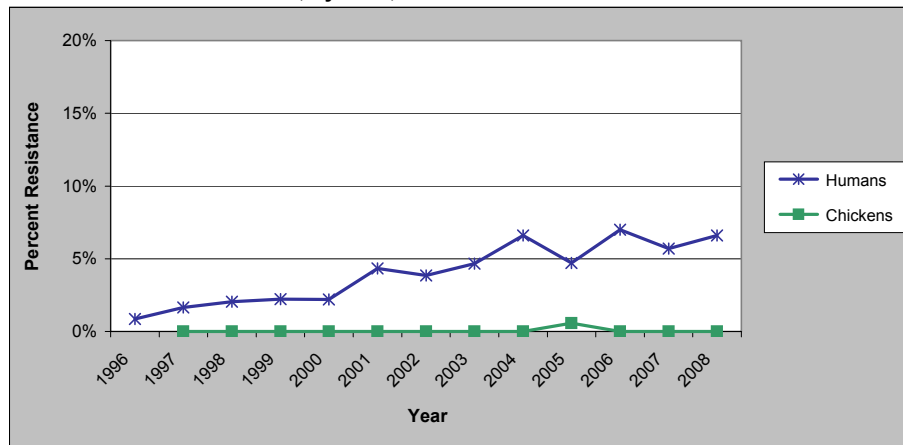
¹ Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

Table 30d. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	301	244	269	319	277	337	257	271	384	413	385	439	
	Chicken Breasts						4	3	3	12	17	13	30	
	Ground Turkey						5	1	0	0	0	0	1	
	Ground Beef						1	1	0	0	0	0	1	
	Pork Chops						0	0	0	0	0	0	0	
	Chickens	1	13	41	31	21	48	42	84	173	188	124	116	
	Turkeys	0	0	1	1	0	0	0	0	0	3	0	1	
	Cattle	1	1	8	4	4	6	3	2	2	2	4	5	
Swine	0	0	2	1	1	1	1	1	0	0	1	0		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)													
	Isolate Source													
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	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	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												
		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	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
		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	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	
Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	Humans	1.7% 5	2.0% 5	2.2% 6	2.2% 7	4.3% 12	3.9% 13	4.7% 12	6.6% 18	4.7% 18	7.0% 29	5.7% 22	6.6% 29
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	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												
		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	0.6% 1	0.0% 0	0.0% 0	0.0% 0
		Turkeys			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	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	
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	9.6% 29	6.6% 16	8.2% 22	1.9% 6	1.8% 5	4.2% 14	1.6% 4	3.3% 9	2.3% 9	1.7% 7	3.9% 15	1.6% 7
		Chicken Breasts						0.0% 0	0.0% 0	33.3% 1	0.0% 0	11.8% 2	0.0% 0	3.3% 1
		Ground Turkey						0.0% 0	0.0% 0					0.0% 0
		Ground Beef						0.0% 0	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	0.6% 1	1.6% 3	2.4% 3	0.9% 1
		Turkeys			0.0% 0	0.0% 0						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	0.0% 0	50.0% 1	25.0% 1	0.0% 0
		Swine			0.0% 0	0.0% 0	100.0% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0	

Nalidixic Acid Resistance

Figure 12. Percent of *Salmonella* Enteritidis Isolates from Humans and Chickens Resistant to Nalidixic Acid, by Year, 1996-2008 ¹



¹ Data for other sources are not included due to the small number of *Salmonella* Enteritidis isolates from these sources. Table 30 contains resistance data for *Salmonella* Enteritidis isolates from each source, by year

Table 31. Number of *Salmonella* Enteritidis Isolates Tested from Humans, Retail Meats, and Food Animals, by Year, 1996-2008

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	351	301	244	269	319	277	337	257	271	384	413	385	439
Chicken Breasts							4	3	3	12	17	13	30
Ground Turkey							5	1	0	0	0	0	1
Ground Beef							1	1	0	0	0	0	1
Pork Chops							0	0	0	0	0	0	0
Chickens		1	13	41	31	21	48	42	84	173	188	124	116
Turkeys		0	0	1	1	0	0	0	0	0	3	0	1
Cattle		1	1	8	4	4	6	3	2	2	2	4	5
Swine		0	0	2	1	1	1	1	1	0	0	1	0

Multidrug Resistance

Table 32a. Resistance Patterns among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	301	244	269	319	277	337	257	271	384	413	385	439
	Chicken Breasts						4	3	3	12	17	13	30
	Ground Turkey						5	1	0	0	0	0	1
	Ground Beef						1	1	0	0	0	0	1
	Pork Chops						0	0	0	0	0	0	0
	Chickens	1	13	41	31	21	48	42	84	173	188	124	116
	Turkeys	0	0	1	1	0	0	0	0	0	3	0	1
	Cattle	1	1	8	4	4	6	3	2	2	2	4	5
	Swine	0	0	2	1	1	1	1	1	1	0	1	0
	Resistance Pattern	Isolate Source											
1. No Resistance Detected	Humans	77.4% 233	87.7% 214	83.6% 225	89.0% 284	86.6% 240	87.5% 295	91.8% 236	87.1% 236	91.4% 351	88.6% 366	90.4% 348	87.9% 386
	Chicken Breasts						100.0% 4	33.3% 1	66.7% 2	100.0% 12	82.4% 14	100.0% 13	90.0% 27
	Ground Turkey						100.0% 5	100.0% 1					100.0% 1
	Ground Beef						100.0% 1	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	97.1% 168	97.9% 184	96.0% 119	97.4% 113
	Turkeys			100.0% 1	100.0% 1						100.0% 3		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	100.0% 2	50.0% 1	75.0% 3	100.0% 1
	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			100.0% 1	
	2. Resistant to ≥ 3 Antimicrobial Classes	Humans	2.7% 8	0.4% 1	1.1% 3	0.3% 1	2.9% 8	2.1% 7	0.4% 1	1.1% 3	1.6% 6	1.7% 7	1.0% 4
Chicken Breasts							0.0% 0	33.3% 1	33.3% 1	0.0% 0	0.0% 0	0.0% 0	33.3% 1
Ground Turkey							0.0% 0	0.0% 0					0.0% 0
Ground Beef							0.0% 0	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	2.4% 2	0.6% 1	0.0% 0	0.0% 0	0.9% 1
Turkeys				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	0.0% 0	50.0% 1	0.0% 0	0.0% 0
Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0	100.0% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0	
3. Resistant to ≥ 4 Antimicrobial Classes		Humans	1.0% 3	0.0% 0	0.4% 1	0.0% 0	1.1% 3	0.6% 2	0.4% 1	0.7% 2	1.0% 4	0.7% 3	0.3% 1
	Chicken Breasts						0.0% 0	0.0% 0	33.3% 1	0.0% 0	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												
	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	0.0% 0	0.0% 0	0.0% 0	0.9% 1
	Turkeys			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	0.0% 0	50.0% 1	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			0.0% 0	
	4. Resistant to ≥ 5 Antimicrobial Classes	Humans	0.7% 2	0.0% 0	0.4% 1	0.0% 0	0.4% 1	0.0% 0	0.4% 1	0.7% 2	0.5% 2	0.2% 1	0.3% 1
Chicken Breasts							0.0% 0	0.0% 0	33.3% 1	0.0% 0	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													
Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	4.2% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.9% 1
Turkeys				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	0.0% 0	50.0% 1	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			0.0% 0	

Table 32b. Resistance Patterns among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	301	244	269	319	277	337	257	271	384	413	385	439
	Chicken Breasts						4	3	3	12	17	13	30
	Ground Turkey						5	1	0	0	0	0	1
	Ground Beef						1	1	0	0	0	0	1
	Pork Chops						0	0	0	0	0	0	0
	Chickens	1	13	41	31	21	48	42	84	173	188	124	116
	Turkeys	0	0	1	1	0	0	0	0	0	3	0	1
	Cattle	1	1	8	4	4	6	3	2	2	2	4	5
	Swine	0	0	2	1	1	1	1	1	0	0	1	0
Resistance Pattern	Isolate Source												
5. At Least ACSSuT¹ Resistant	Humans	0.3%	0.0%	0.4%	0.0%	0.0%	0.0%	0.4%	0.4%	0.5%	0.0%	0.3%	0.0%
		1	0	1	0	0	0	1	1	2	0	1	0
	Chicken Breasts						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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												
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%	
	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	
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%	
	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	0	0	0	0	0			0	
6. At Least ACT/S² Resistant	Humans	0.3%	0.0%	0.4%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%
		1	0	1	0	0	0	1	0	0	0	0	0
	Chicken Breasts						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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												
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%	
	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	
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%	
	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	0	0	0	0	0			0	
7. At Least ACSSuTAuCf³ Resistant	Humans	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.3%	0.0%
		0	0	1	0	0	0	0	0	1	0	1	0
	Chicken Breasts						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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												
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%	
	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	
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%	
	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	0	0	0	0	0			0	
8. At Least Ceftiofur and Nalidixic Acid Resistant	Humans	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.3%	0.0%
		1	0	0	0	0	0	0	0	1	0	1	0
	Chicken Breasts						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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												
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%	
	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	
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%	
	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	0	0	0	0	0			0	

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

F. Antimicrobial Susceptibility among *Salmonella* Typhimurium

Table 33a. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	328	381	363	304	325	394	408	382	438	409	403	397	
	Chicken Breasts						9	22	49	29	21	25	68	
	Ground Turkey						2	2	2	1	0	1	3	
	Ground Beef						2	1	0	0	1	3	2	
	Pork Chops						2	1	2	2	2	3	3	
	Chickens	24	66	154	145	130	150	156	171	183	105	83	70	
	Turkeys	4	6	37	18	15	9	6	14	7	5	6	3	
	Cattle	1	33	189	187	87	98	78	48	34	22	26	28	
	Swine	25	104	114	81	44	48	27	53	42	25	44	10	
	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%	
		Chicken Breasts	0	0	0	0	0	0	0	0	0	0	0	
		Ground Turkey						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
		Ground Beef						0.0%	0.0%		0.0%	0.0%	0.0%	
		Pork Chops						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%	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%	
		Cattle	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%	2.3%	
	Gentamicin (MIC ≥ 16 µg/ml)	Humans	4.6%	3.7%	2.2%	2.6%	1.5%	2.3%	2.0%	2.1%	1.8%	2.7%	2.5%	1.5%
		Chicken Breasts	15	14	8	8	5	9	8	8	8	11	10	6
		Ground Turkey						0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	
		Ground Beef						0.0%	0.0%			0.0%	0.0%	
		Pork Chops						0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	
		Chickens	20.8%	18.5%	16.9%	15.2%	3.1%	12.7%	5.1%	4.1%	4.4%	6.7%	3.6%	5.7%
		Turkeys	5	12	26	22	4	19	8	7	8	7	3	4
		Cattle	75.0%	50.0%	29.7%	33.3%	53.3%	44.4%	83.3%	64.3%	14.3%	20.0%	16.7%	33.3%
		Swine	3	3	11	6	8	4	5	9	1	1	1	1
	Kanamycin (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%	
		Chicken Breasts	0	0	0	0	0	0	0	0	0	0	0	
		Ground Turkey						0.0%	50.0%	50.0%	0.0%	0.0%	0.0%	
		Ground Beef						0.0%	0.0%		0.0%	0.0%	0.0%	
		Pork Chops						0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	
		Chickens	8.3%	4.6%	3.9%	3.4%	3.1%	5.3%	7.7%	9.9%	7.7%	18.1%	7.2%	8.6%
		Turkeys	2	3	6	5	4	8	12	17	14	19	6	6
		Cattle	100.0%	66.7%	59.5%	44.4%	73.3%	55.6%	50.0%	21.4%	0.0%	0.0%	16.7%	0.0%
		Swine	4	4	22	8	11	5	3	3	0	0	1	0
	Streptomycin (MIC ≥ 64 µg/ml)	Humans	0.0%	54.5%	36.5%	27.3%	24.1%	26.5%	16.7%	14.6%	38.2%	13.6%	26.9%	14.3%
		Chicken Breasts	0	18	69	51	21	26	13	7	13	3	7	4
		Ground Turkey	16.0%	18.3%	21.1%	14.8%	13.6%	2.1%	0.0%	9.4%	7.1%	16.0%	9.1%	10.0%
		Ground Beef	4	19	24	12	6	1	0	5	3	4	4	1
		Pork Chops	55.2%	47.8%	43.3%	39.5%	40.0%	32.0%	35.5%	31.7%	28.1%	29.3%	32.3%	28.5%
		Chickens	181	182	157	120	130	126	145	121	123	120	130	113
		Turkeys						0.0%	18.2%	14.3%	3.4%	9.5%	28.0%	16.2%
		Cattle						0.0%	50.0%	50.0%	0.0%	100.0%	0.0%	50.0%
		Swine						0.0%	0.0%			100.0%	0.0%	50.0%
Aminoglycosides	Streptomycin (MIC ≥ 64 µg/ml)	Humans	41.7%	44.6%	40.9%	35.9%	16.9%	30.0%	16.7%	8.2%	13.7%	17.1%	10.8%	
		Chicken Breasts	10	29	63	52	22	45	26	14	25	18	9	
		Ground Turkey						0.0%	50.0%	50.0%	0.0%		100.0%	
		Ground Beef						0.0%	0.0%			100.0%	0.0%	
		Pork Chops						50.0%	100.0%	100.0%	100.0%	100.0%	0.0%	
		Chickens	1	1	2	2	2	1	2	2	2	2	0	
		Turkeys	100.0%	83.3%	81.1%	72.2%	93.3%	77.8%	100.0%	64.3%	57.1%	60.0%	50.0%	
		Cattle	4	5	30	13	14	7	6	9	4	3	3	
		Swine	100.0%	57.6%	63.0%	63.1%	46.0%	66.3%	52.6%	56.3%	55.9%	54.5%	50.0%	

Table 33b. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested		328	381	363	304	325	394	408	382	438	409	403	397	
Humans														
Chicken Breasts							9	22	49	29	21	25	68	
Ground Turkey							2	2	2	1	0	1	3	
Ground Beef							2	1	0	0	1	3	2	
Pork Chops							2	1	2	2	2	3	3	
Chickens		24	66	154	145	130	150	156	171	183	105	83	70	
Turkeys		4	6	37	18	15	9	6	14	7	5	6	3	
Cattle		1	33	189	187	87	98	78	48	34	22	26	28	
Swine		25	104	114	81	44	48	27	53	42	25	44	10	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	3.4% 11	4.5% 17	2.8% 10	6.3% 19	6.2% 20	7.6% 30	5.6% 23	4.7% 18	3.2% 14	4.4% 18	6.5% 26	3.3% 13
		Chicken Breasts						33.3% 3	63.6% 14	49.0% 24	51.7% 15	57.1% 12	44.0% 11	50.0% 34
		Ground Turkey						0.0% 0	100.0% 2	0.0% 0	100.0% 1		0.0% 0	33.3% 1
		Ground Beef						0.0% 0	0.0% 0			0.0% 0	0.0% 0	0.0% 0
		Pork Chops						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chickens	0.0% 0	9.2% 6	29.2% 45	25.5% 37	14.6% 19	28.7% 43	25.6% 40	43.3% 74	19.7% 36	30.5% 32	33.7% 28	24.3% 17
		Turkeys	75.0% 3	0.0% 0	51.4% 19	38.9% 7	53.3% 8	22.2% 2	16.7% 1	14.3% 2	0.0% 0	0.0% 0	16.7% 1	0.0% 0
		Cattle	100.0% 1	6.1% 2	6.9% 13	12.8% 24	13.8% 12	17.3% 17	20.5% 16	25.0% 12	35.3% 12	27.3% 6	26.9% 7	21.4% 6
		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	9.5% 4	0.0% 0	2.3% 1	0.0% 0
Cephems	Cefoxitin (MIC ≥ 32 µg/ml)	Humans				3.6% 11	3.1% 10	4.3% 17	4.4% 18	4.7% 18	2.5% 11	3.9% 16	5.5% 22	3.3% 13
		Chicken Breasts						33.3% 3	63.6% 14	49.0% 24	51.7% 15	52.4% 11	40.0% 10	47.1% 32
		Ground Turkey						0.0% 0	100.0% 2	0.0% 0	100.0% 1		0.0% 0	33.3% 1
		Ground Beef						0.0% 0	0.0% 0			0.0% 0	0.0% 0	0.0% 0
		Pork Chops						0.0% 0	0.0% 0	0.0% 0	0.0% 0	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	19.7% 36	29.5% 31	24.1% 20	20.0% 14
		Turkeys				38.9% 7	53.3% 8	22.2% 2	16.7% 1	14.3% 2	0.0% 0	0.0% 0	16.7% 1	0.0% 0
		Cattle				9.1% 17	11.5% 10	11.2% 11	16.7% 13	25.0% 12	35.3% 12	27.3% 6	26.9% 7	17.9% 5
		Swine				1.2% 1	0.0% 0	4.2% 2	3.7% 1	0.0% 0	4.8% 2	0.0% 0	4.5% 2	0.0% 0
	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	1.5% 5	1.8% 7	1.9% 7	3.6% 11	3.1% 10	4.3% 17	4.9% 20	4.5% 17	2.5% 11	4.2% 17	6.2% 25	3.3% 13
		Chicken Breasts						33.3% 3	63.6% 14	49.0% 24	51.7% 15	57.1% 12	44.0% 11	50.0% 34
		Ground Turkey						0.0% 0	100.0% 2	0.0% 0	100.0% 1		0.0% 0	33.3% 1
		Ground Beef						0.0% 0	0.0% 0			0.0% 0	0.0% 0	0.0% 0
		Pork Chops						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chickens	0.0% 0	9.2% 6	29.9% 46	26.2% 38	14.6% 19	28.0% 42	25.6% 40	43.3% 74	19.7% 36	30.5% 32	32.5% 27	24.3% 17
		Turkeys	75.0% 3	0.0% 0	48.6% 18	38.9% 7	53.3% 8	22.2% 2	16.7% 1	14.3% 2	0.0% 0	0.0% 0	16.7% 1	0.0% 0
		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	35.3% 12	27.3% 6	26.9% 7	21.4% 6
		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	4.8% 2	0.0% 0	2.3% 1	0.0% 0
Ceftriaxone (MIC ≥ 4 µg/ml) ¹	Humans	1.5% 5	1.8% 7	1.9% 7	3.3% 10	3.1% 10	4.3% 17	4.9% 20	4.5% 17	2.5% 11	4.2% 17	6.2% 25	3.3% 13	
	Chicken Breasts						33.3% 3	63.6% 14	49.0% 24	51.7% 15	57.1% 12	44.0% 11	50.0% 34	
	Ground Turkey						0.0% 0	100.0% 2	0.0% 0	100.0% 1		0.0% 0	33.3% 1	
	Ground Beef						0.0% 0	0.0% 0			0.0% 0	0.0% 0	0.0% 0	
	Pork Chops						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
	Chickens	0.0% 0	9.2% 6	28.6% 44	26.2% 38	14.6% 19	26.7% 40	25.6% 40	43.3% 74	19.7% 36	30.5% 32	33.7% 28	24.3% 17	
	Turkeys	75.0% 3	0.0% 0	48.6% 18	38.9% 7	53.3% 8	22.2% 2	16.7% 1	14.3% 2	0.0% 0	0.0% 0	16.7% 1	0.0% 0	
	Cattle	0.0% 0	3.0% 1	6.3% 12	11.8% 22	11.5% 10	15.3% 15	20.5% 16	25.0% 12	35.3% 12	27.3% 6	26.9% 7	21.4% 6	
	Swine	0.0% 0	0.0% 0	0.9% 1	0.0% 0	0.0% 0	4.2% 2	0.0% 0	0.0% 0	4.8% 2	0.0% 0	2.3% 1	0.0% 0	

¹Breakpoints for ceftriaxone were revised to reflect those published in CLSI document M100-S20

Table 33c. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	328	381	363	304	325	394	408	382	438	409	403	397	
	Chicken Breasts						9	22	49	29	21	25	68	
	Ground Turkey						2	2	2	1	0	1	3	
	Ground Beef						2	1	0	0	1	3	2	
	Pork Chops						2	1	2	2	2	3	3	
	Chickens	24	66	154	145	130	150	156	171	183	105	83	70	
	Turkeys	4	6	37	18	15	9	6	14	7	5	6	3	
	Cattle	1	33	189	187	87	98	78	48	34	22	26	28	
	Swine	25	104	114	81	44	48	27	53	42	25	44	10	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Folate Pathway Inhibitors	Sulfamethoxazole/Sulfisoxazole ¹ (MIC ≥ 512 µg/ml)	Humans	56.7% 186	50.1% 191	45.7% 166	45.4% 138	43.1% 140	32.2% 127	38.7% 158	35.9% 137	32.0% 140	33.3% 136	37.2% 150	30.2% 120
		Chicken Breasts						44.4% 4	31.8% 7	73.5% 36	69.0% 20	90.5% 19	68.0% 17	95.6% 65
		Ground Turkey						0.0% 0	50.0% 1	100.0% 2	0.0% 0		100.0% 1	66.7% 2
		Ground Beef						0.0% 0	0.0% 0			100.0% 1	0.0% 0	50.0% 1
		Pork Chops						50.0% 1	100.0% 1	100.0% 2	100.0% 2	100.0% 2	0.0% 0	33.3% 1
		Chickens	41.7% 10	36.9% 24	32.5% 50	34.5% 50	18.5% 24	31.3% 47	28.2% 44	47.4% 81	37.2% 68	65.7% 69	60.2% 50	70.0% 49
		Turkeys	75.0% 3	83.3% 5	75.7% 28	66.7% 12	86.7% 13	77.8% 7	100.0% 6	78.6% 11	57.1% 4	80.0% 4	83.3% 5	66.7% 2
		Cattle	100.0% 1	60.6% 20	64.6% 122	64.2% 120	54.0% 47	58.2% 57	44.9% 35	60.4% 29	73.5% 25	59.1% 13	65.4% 17	53.6% 15
		Swine	80.0% 20	83.7% 87	78.9% 90	86.4% 70	75.0% 33	68.8% 33	63.0% 17	81.1% 43	69.0% 29	96.0% 24	77.3% 34	80.0% 8
	Trimethoprim-Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	3.0% 10	4.5% 17	2.8% 10	3.6% 11	2.5% 8	2.3% 9	3.4% 14	2.6% 10	2.7% 12	2.2% 9	2.2% 9	1.8% 7
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0		0.0% 0	0.0% 0
		Ground Beef						0.0% 0	0.0% 0			0.0% 0	0.0% 0	0.0% 0
		Pork Chops						0.0% 0	0.0% 0	0.0% 0	50.0% 1	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	1.3% 2	0.6% 1	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	11.1% 2	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	6.1% 2	9.0% 17	2.1% 4	2.3% 2	4.1% 4	2.6% 2	4.2% 2	5.9% 2	4.5% 1	0.0% 0	0.0% 0
		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	9.5% 4	4.0% 1	9.1% 4	10.0% 1
		Penicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	50.3% 165	45.7% 174	41.3% 150	42.1% 128	42.5% 138	33.8% 133	36.3% 148	31.9% 122	29.0% 127	28.1% 115
Chicken Breasts								33.3% 3	72.7% 16	53.1% 26	55.2% 16	57.1% 12	48.0% 12	61.8% 42
Ground Turkey								0.0% 0	100.0% 2	50.0% 1	100.0% 1		100.0% 1	33.3% 1
Ground Beef								0.0% 0	0.0% 0			100.0% 1	0.0% 0	50.0% 1
Pork Chops								50.0% 1	100.0% 1	50.0% 1	100.0% 2	100.0% 2	0.0% 0	0.0% 0
Chickens	33.3% 8			29.2% 19	43.5% 67	42.1% 61	26.2% 34	45.3% 68	32.1% 50	46.8% 80	26.8% 49	42.9% 45	37.3% 31	28.6% 20
Turkeys	75.0% 3			50.0% 3	64.9% 24	66.7% 12	80.0% 12	55.6% 5	66.7% 4	28.6% 4	57.1% 4	80.0% 4	83.3% 5	33.3% 1
Cattle	100.0% 1			57.6% 19	66.1% 125	63.1% 118	57.5% 50	71.4% 70	59.0% 46	60.4% 29	73.5% 25	63.6% 14	61.5% 16	50.0% 14
Swine	72.0% 18			75.0% 78	64.0% 73	82.7% 67	63.6% 28	62.5% 30	51.9% 14	71.7% 38	66.7% 28	76.0% 19	70.5% 31	70.0% 7
Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)			Humans	36.0% 118	34.1% 130	28.9% 105	30.9% 94	31.7% 103	23.4% 92	28.2% 115	24.1% 92	24.4% 107	22.0% 90
		Chicken Breasts						0.0% 0	9.1% 2	4.1% 2	3.4% 1	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0	50.0% 1	50.0% 1	0.0% 0		100.0% 1	33.3% 1
		Ground Beef						0.0% 0	0.0% 0			100.0% 1	0.0% 0	50.0% 1
		Pork Chops						50.0% 1	100.0% 1	100.0% 2	100.0% 2	0.0% 0	0.0% 0	0.0% 0
		Chickens	20.8% 5	18.5% 12	10.4% 16	14.5% 21	11.5% 15	16.0% 24	5.1% 8	1.8% 3	8.2% 15	7.6% 8	1.2% 1	1.4% 1
		Turkeys	75.0% 3	0.0% 0	54.1% 20	55.6% 10	73.3% 11	66.7% 6	50.0% 3	28.6% 4	57.1% 4	60.0% 3	66.7% 4	33.3% 1
		Cattle	100.0% 1	27.3% 9	37.0% 70	42.8% 80	37.9% 33	49.0% 48	42.3% 33	54.2% 26	47.1% 16	50.0% 11	65.4% 17	35.7% 10
		Swine	52.0% 13	56.7% 59	49.1% 56	53.1% 43	47.7% 21	56.3% 27	48.1% 13	60.4% 32	54.8% 23	64.0% 16	65.9% 29	50.0% 5

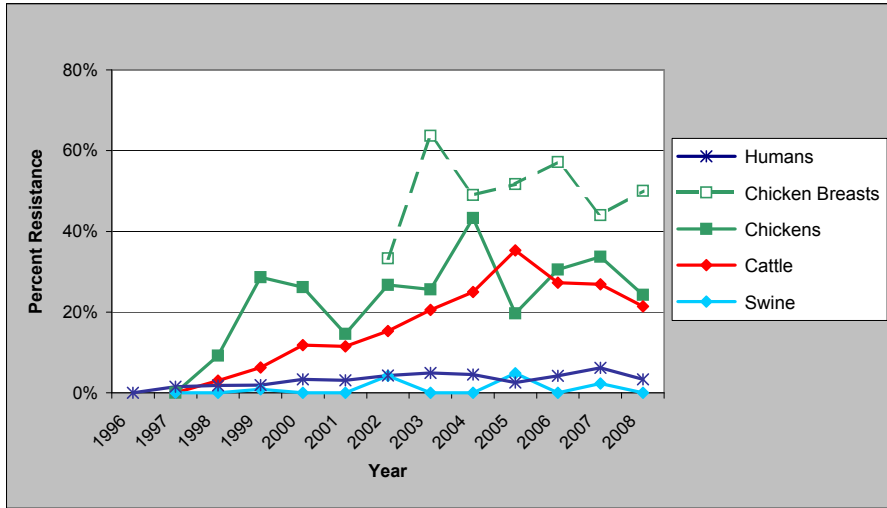
¹ Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

Table 33d. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	328	381	363	304	325	394	408	382	438	409	403	397	
	Chicken Breasts						9	22	49	29	21	25	68	
	Ground Turkey						2	2	2	1	0	1	3	
	Ground Beef						2	1	0	0	1	3	2	
	Pork Chops						2	1	2	2	2	3	3	
	Chickens	24	66	154	145	130	150	156	171	183	105	83	70	
	Turkeys	4	6	37	18	15	9	6	14	7	5	6	3	
	Cattle	1	33	189	187	87	98	78	48	34	22	26	28	
	Swine	25	104	114	81	44	48	27	53	42	25	44	10	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.2% 1	0.0% 0	0.0% 0
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0		0.0% 0	0.0% 0
		Ground Beef						0.0% 0	0.0% 0			0.0% 0	0.0% 0	0.0% 0
		Pork Chops						0.0% 0	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	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	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	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	0.9% 3	0.5% 2	0.0% 0	1.3% 4	0.6% 2	1.3% 5	1.2% 5	0.5% 2	0.9% 4	0.7% 3	1.5% 6	1.3% 5
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0	50.0% 1	0.0% 0	0.0% 0		0.0% 0	0.0% 0
		Ground Beef						0.0% 0	0.0% 0			0.0% 0	0.0% 0	0.0% 0
		Pork Chops						0.0% 0	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	0.6% 1	0.7% 1	0.0% 0	2.7% 4	0.0% 0	0.0% 0	1.1% 2	0.0% 0	0.0% 0	0.0% 0
		Turkeys	75.0% 3	0.0% 0	51.4% 19	33.3% 6	60.0% 9	55.6% 5	33.3% 2	14.3% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		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	0.0% 0	0.0% 0	2.3% 1	0.0% 0
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	52.4% 172	46.5% 177	41.9% 152	43.4% 132	43.4% 141	32.0% 126	38.2% 156	30.1% 115	30.4% 133	31.5% 129	36.7% 148	27.5% 109
		Chicken Breasts						44.4% 4	31.8% 7	71.4% 35	69.0% 20	90.5% 19	72.0% 18	94.1% 64
		Ground Turkey						0.0% 0	50.0% 1	100.0% 2	0.0% 0		100.0% 1	66.7% 2
		Ground Beef						0.0% 0	0.0% 0			100.0% 1	0.0% 0	50.0% 1
		Pork Chops						100.0% 2	100.0% 1	100.0% 2	100.0% 2	100.0% 2	66.7% 2	33.3% 1
		Chickens	33.3% 8	30.8% 20	32.5% 50	32.4% 47	16.2% 21	28.0% 42	33.3% 52	44.4% 76	34.4% 63	61.0% 64	60.2% 50	64.3% 45
		Turkeys	100.0% 4	83.3% 5	78.4% 29	83.3% 15	93.3% 14	77.8% 7	100.0% 6	78.6% 11	57.1% 4	100.0% 5	66.7% 4	66.7% 2
		Cattle	100.0% 1	63.6% 21	58.7% 111	61.5% 115	44.8% 39	64.3% 63	53.8% 42	60.4% 29	67.6% 23	54.5% 12	65.4% 17	50.0% 14
		Swine	84.0% 21	89.4% 93	84.2% 96	90.1% 73	79.5% 35	89.6% 43	74.1% 20	90.6% 48	83.3% 35	96.0% 24	88.6% 39	100.0% 10

Ceftriaxone Resistance

Figure 13. Percent of *Salmonella* Typhimurium Isolates from Humans, Retail Chicken Breasts, and Food Animals Resistant to Ceftriaxone by Year, 1997-2008¹



¹ Data for ground turkey, ground beef, pork chops, and turkeys are not included due to the small number of *Salmonella* Typhimurium isolates from these sources. Table 33 contains resistance data for *Salmonella* Typhimurium isolates from each source, by year

Table 34. Number of *Salmonella* Typhimurium Isolates Tested from Humans, Retail Meats, and Food Animals, by Year, 1996-2008

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	307	328	381	363	304	325	394	408	382	438	409	403	397
Chicken Breasts							9	22	49	29	21	25	68
Ground Turkey							2	2	2	1	0	1	3
Ground Beef							2	1	0	0	1	3	2
Pork Chops							2	1	2	2	2	3	3
Chickens		24	66	154	145	130	150	156	171	183	105	83	70
Turkeys		4	6	37	18	15	9	6	14	7	5	6	3
Cattle		1	33	189	187	87	98	78	48	34	22	26	28
Swine		25	104	114	81	44	48	27	53	42	25	44	10

Multidrug Resistance

Table 35a. Resistance Patterns among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	328	381	363	304	325	394	408	382	438	409	403	397
	Chicken Breasts						9	22	49	29	21	25	68
	Ground Turkey						2	2	2	1	0	1	3
	Ground Beef						2	1	0	0	1	3	2
	Pork Chops						2	1	2	2	2	3	3
	Chickens	24	66	154	145	130	150	156	171	183	105	83	70
	Turkeys	4	6	37	18	15	9	6	14	7	5	6	3
	Cattle	1	33	189	187	87	98	78	48	34	22	26	28
	Swine	25	104	114	81	44	48	27	53	42	25	44	10
	Resistance Pattern	Isolate Source											
1. No Resistance Detected	Humans	39.0% 128	46.5% 177	50.4% 183	49.3% 150	49.2% 160	59.9% 236	54.7% 223	60.7% 232	65.1% 285	62.6% 256	57.6% 232	68.0% 270
	Chicken Breasts						22.2% 2	22.7% 5	14.3% 7	24.1% 7	0.0% 0	24.0% 6	4.4% 3
	Ground Turkey						100.0% 2	0.0% 0	0.0% 0	0.0% 0		0.0% 0	33.3% 1
	Ground Beef						100.0% 2	100.0% 1			0.0% 0	100.0% 3	50.0% 1
	Pork Chops						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	33.3% 1	66.7% 2
	Chickens	37.5% 9	40.0% 26	29.2% 45	31.7% 46	64.6% 84	37.3% 56	45.5% 71	40.9% 70	54.1% 99	30.5% 32	30.1% 25	27.1% 19
	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	42.9% 3	0.0% 0	16.7% 1	0.0% 0
	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	28.5% 9	31.8% 7	34.6% 9	46.4% 13
	Swine	12.0% 3	7.7% 8	7.9% 9	2.5% 2	13.6% 6	8.3% 4	18.5% 5	3.8% 2	16.7% 7	0.0% 0	6.8% 3	0.0% 0
	2. Resistant to ≥ 3 Antimicrobial Classes	Humans	51.8% 170	46.7% 178	43.0% 156	43.4% 132	41.5% 135	32.5% 128	37.3% 152	31.4% 120	30.1% 132	30.3% 124	34.2% 138
Chicken Breasts							33.3% 3	72.7% 16	71.4% 35	58.6% 17	81.0% 17	68.0% 17	79.4% 54
Ground Turkey							0.0% 0	100.0% 2	100.0% 2	100.0% 1		100.0% 1	33.3% 1
Ground Beef							0.0% 0	0.0% 0			100.0% 1	0.0% 0	50.0% 1
Pork Chops							50.0% 1	100.0% 1	100.0% 2	100.0% 2	100.0% 2	0.0% 0	33.3% 1
Chickens		29.2% 7	31.8% 21	47.4% 73	48.3% 70	28.5% 37	46.0% 69	34.6% 54	48.5% 83	30.6% 56	55.2% 58	39.8% 33	31.4% 22
Turkeys		75.0% 3	83.3% 5	73.0% 27	66.7% 12	86.7% 13	77.8% 7	100.0% 6	71.4% 10	57.1% 4	80.0% 4	83.3% 5	33.3% 1
Cattle		100.0% 1	60.6% 20	64.0% 121	64.2% 120	50.6% 44	70.4% 69	59.0% 46	60.4% 29	73.5% 25	59.1% 13	65.4% 17	50.0% 14
Swine		76.0% 19	81.7% 85	78.9% 90	86.4% 70	70.5% 31	75.0% 36	55.6% 15	77.4% 41	71.4% 30	96.0% 24	72.7% 32	80.0% 8
3. Resistant to ≥ 4 Antimicrobial Classes		Humans	46.6% 153	43.3% 165	38.6% 140	39.8% 121	37.8% 123	28.4% 112	32.4% 132	27.5% 105	27.4% 120	26.9% 110	29.8% 120
	Chicken Breasts						0.0% 0	36.4% 8	46.9% 23	48.3% 14	47.6% 10	40.0% 10	55.9% 38
	Ground Turkey						0.0% 0	50.0% 1	50.0% 1	0.0% 0		100.0% 1	33.3% 1
	Ground Beef						0.0% 0	0.0% 0			100.0% 1	0.0% 0	50.0% 1
	Pork Chops						50.0% 1	100.0% 1	100.0% 2	100.0% 2	100.0% 2	0.0% 0	0.0% 0
	Chickens	20.8% 5	18.2% 12	22.7% 35	20.7% 30	13.1% 17	25.3% 38	19.9% 31	37.4% 64	21.3% 39	38.1% 40	31.3% 26	25.7% 18
	Turkeys	75.0% 3	50.0% 3	62.2% 23	61.1% 11	86.7% 13	66.7% 6	66.7% 4	28.6% 4	57.1% 4	60.0% 3	66.7% 4	33.3% 1
	Cattle	100.0% 1	60.6% 20	55.0% 104	55.6% 104	41.4% 36	58.2% 57	51.3% 40	60.4% 29	64.7% 22	54.5% 12	61.5% 16	46.4% 13
	Swine	72.0% 18	72.1% 75	57.0% 65	74.1% 60	54.5% 24	60.4% 29	51.9% 14	71.7% 38	66.7% 28	72.0% 18	70.5% 31	70.0% 7
	4. Resistant to ≥ 5 Antimicrobial Classes	Humans	35.7% 117	34.1% 130	28.1% 102	29.6% 90	29.5% 96	23.1% 91	27.7% 113	24.1% 92	22.8% 100	20.8% 85	24.8% 100
Chicken Breasts							0.0% 0	27.3% 6	44.9% 22	48.3% 14	47.6% 10	40.0% 10	48.5% 33
Ground Turkey							0.0% 0	50.0% 1	50.0% 1	0.0% 0		100.0% 1	33.3% 1
Ground Beef							0.0% 0	0.0% 0			100.0% 1	0.0% 0	50.0% 1
Pork Chops							50.0% 1	100.0% 1	50.0% 1	100.0% 2	0.0% 0	0.0% 0	0.0% 0
Chickens		12.5% 3	16.7% 11	15.6% 24	17.2% 25	12.3% 16	20.0% 30	17.3% 27	36.3% 62	19.7% 36	35.2% 37	30.1% 25	22.8% 16
Turkeys		75.3% 3	0.0% 0	56.8% 21	55.6% 10	73.3% 11	55.6% 5	50.0% 3	28.6% 4	57.1% 4	60.0% 3	33.3% 2	33.3% 1
Cattle		100.0% 1	24.2% 8	34.9% 66	38.0% 71	34.5% 30	35.7% 35	33.3% 26	58.3% 28	50.0% 17	50.0% 11	61.5% 16	35.7% 10
Swine		32.0% 8	56.7% 59	46.5% 53	43.2% 35	45.5% 20	47.9% 23	48.1% 13	60.4% 32	54.8% 23	44.0% 11	47.7% 21	40.0% 4

Table 35b. Resistance Patterns among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	328	381	363	304	325	394	408	382	438	409	403	397
	Chicken Breasts						9	22	49	29	21	25	68
	Ground Turkey						2	2	2	1	0	1	3
	Ground Beef						2	1	0	0	1	3	2
	Pork Chops						2	1	2	2	2	3	3
	Chickens	24	66	154	145	130	150	156	171	183	105	83	70
	Turkeys	4	6	37	18	15	9	6	14	7	5	6	3
	Cattle	1	33	189	187	87	98	78	48	34	22	26	28
	Swine	25	104	114	81	44	48	27	53	42	25	44	10
Resistance Pattern	Isolate Source												
5. At Least ACSSuT¹ Resistant	Humans	35.1% 115	32.5% 124	27.8% 101	28.0% 85	29.5% 96	21.6% 85	26.5% 108	23.3% 89	22.4% 98	19.6% 80	22.6% 91	22.9% 91
	Chicken Breasts						0.0% 0	9.1% 2	4.1% 2	3.5% 1	0.0% 0	0.0% 0	0.0% 0
	Ground Turkey						0.0% 0	50.0% 1	50.0% 1	0.0% 0		100.0% 1	33.3% 1
	Ground Beef						0.0% 0	0.0% 0			100.0% 1	0.0% 0	50.0% 1
	Pork Chops						50.0% 1	100.0% 1	50.0% 1	100.0% 2	0.0% 0	0.0% 0	0.0% 0
	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	7.1% 13	6.7% 7	1.2% 1	0.0% 0
	Turkeys	75.0% 3	0.0% 0	51.4% 19	50.0% 9	66.7% 10	44.4% 4	50.0% 3	28.6% 4	57.1% 4	60.0% 3	33.3% 2	33.3% 1
	Cattle	100.0% 1	21.2% 7	32.8% 62	37.4% 70	31.0% 27	31.6% 31	28.2% 22	54.2% 26	41.2% 14	50.0% 11	50.0% 13	35.7% 10
	Swine	20.0% 5	54.8% 57	46.5% 53	39.5% 32	45.5% 20	47.9% 23	44.4% 12	60.4% 32	50.0% 21	44.0% 11	47.7% 21	30.0% 3
6. At Least ACT/S² Resistant	Humans	0.6% 2	2.6% 10	2.2% 8	1.6% 5	0.9% 3	2.0% 8	3.2% 13	1.6% 6	2.1% 9	0.7% 3	1.7% 7	0.5% 2
	Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0		0.0% 0	0.0% 0
	Ground Beef						0.0% 0	0.0% 0			0.0% 0	0.0% 0	0.0% 0
	Pork Chops						0.0% 0	0.0% 0	0.0% 0	50.0% 1	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	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Cattle	0.0% 0	6.1% 2	8.5% 16	0.5% 1	2.3% 2	3.1% 3	2.6% 2	4.2% 2	2.9% 1	4.5% 1	0.0% 0	0.0% 0
	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	7.1% 3	4.0% 1	9.1% 4	0.0% 0
7. At Least ACSSuTAuCf³ Resistant	Humans	1.2% 4	1.0% 4	0.6% 2	2.0% 6	1.2% 4	1.8% 7	2.2% 9	2.6% 10	1.8% 8	2.9% 12	3.5% 14	2.0% 8
	Chicken Breasts						0.0% 0	0.0% 0	4.1% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Turkey						0.0% 0	50.0% 1	0.0% 0	0.0% 0		0.0% 0	33.3% 1
	Ground Beef						0.0% 0	0.0% 0			0.0% 0	0.0% 0	0.0% 0
	Pork Chops						0.0% 0	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	0.6% 1	0.7% 1	0.0% 0	2.0% 3	0.6% 1	0.0% 0	1.1% 2	0.0% 0	0.0% 0	0.0% 0
	Turkeys	75.0% 3	0.0% 0	45.9% 17	33.3% 6	53.3% 8	11.1% 1	16.7% 1	14.3% 2	0.0% 0	0.0% 0	16.7% 1	0.0% 0
	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	26.5% 9	22.7% 5	26.9% 7	21.4% 6
	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	2.4% 1	0.0% 0	2.3% 1	0.0% 0
8. At Least Ceftiofur and Nalidixic Acid Resistant	Humans	0.3% 1	0.0% 0	0.0% 0	0.3% 1	0.3% 1	0.5% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.2% 1	0.0% 0
	Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Turkey						0.0% 0	50.0% 1	0.0% 0	0.0% 0		0.0% 0	0.0% 0
	Ground Beef						0.0% 0	0.0% 0			0.0% 0	0.0% 0	0.0% 0
	Pork Chops						0.0% 0	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	0.6% 1	0.7% 1	0.0% 0	2.7% 4	0.0% 0	0.0% 0	0.5% 1	0.0% 0	0.0% 0	0.0% 0
	Turkeys	50.0% 2	0.0% 0	48.6% 18	33.3% 6	53.3% 8	22.2% 2	16.7% 1	14.3% 2	0.0% 0	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	4.2% 2	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	2.1% 1	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

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

G. Antimicrobial Susceptibility among *Salmonella* Newport

Table 36a. Antimicrobial Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	46	77	99	121	124	241	223	191	207	217	220	252	
	Chicken Breasts						0	0	0	0	0	0	0	
	Ground Turkey						3	2	2	3	0	0	3	
	Ground Beef						3	1	2	0	0	0	3	
	Pork Chops						2	1	0	0	0	0	0	
	Chickens	0	1	7	5	8	6	7	0	6	0	3	1	
	Turkeys	0	1	4	6	16	10	19	7	5	4	15	8	
	Cattle	0	8	54	109	87	113	75	44	27	30	30	31	
	Swine	0	1	5	2	7	0	3	0	1	1	1	2	
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	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	0.0% 0			0.0% 0
		Ground Beef						0.0% 0	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		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	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	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	0.0% 0	0.0% 0
	Gentamicin (MIC ≥ 16)	Humans	4.3% 2	0.0% 0	0.0% 0	2.5% 3	3.2% 4	3.3% 8	3.1% 7	0.5% 1	1.0% 2	0.9% 2	0.9% 2	0.4% 1
		Chicken Breasts												
		Ground Turkey						0.0% 0	50.0% 1	0.0% 0	0.0% 0			33.3% 1
		Ground Beef						0.0% 0	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		16.7% 1		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	80.0% 4	50.0% 2	0.0% 0	25.0% 2
		Cattle		0.0% 0	1.9% 1	11.0% 12	6.9% 6	7.1% 8	1.3% 1	0.0% 0	0.0% 0	3.3% 1	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	0.0% 0
	Kanamycin (MIC ≥ 64)	Humans	0.0% 0	1.3% 1	1.0% 1	5.0% 6	7.3% 9	10.0% 24	4.5% 10	2.6% 5	1.9% 4	2.3% 5	0.9% 2	3.2% 8
		Chicken Breasts												
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0			0.0% 0
		Ground Beef						0.0% 0	0.0% 0	0.0% 0				33.3% 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		33.3% 2		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	80.0% 4	50.0% 2	6.7% 1	37.5% 3
		Cattle		0.0% 0	0.0% 0	9.2% 10	6.9% 6	15.9% 18	17.3% 13	25.0% 11	14.8% 4	13.3% 4	10.0% 3	0.0% 0
		Swine		0.0% 0	0.0% 0	0.0% 0	57.1% 4		0.0% 0		0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Streptomycin (MIC ≥ 64)	Humans	4.3% 2	2.6% 2	19.2% 19	24.0% 29	31.5% 39	25.3% 61	24.2% 54	15.7% 30	14.0% 29	13.8% 30	10.0% 22	13.5% 34
		Chicken Breasts												
		Ground Turkey						33.3% 1	50.0% 1	0.0% 0	0.0% 0			33.3% 1
		Ground Beef						66.7% 2	100.0% 1	100.0% 2				66.7% 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		50.0% 3		0.0% 0	100.0% 1
		Turkeys		0.0% 0	0.0% 0	16.7% 1	12.5% 2	0.0% 0	31.6% 6	14.3% 1	80.0% 4	0.0% 0	6.7% 1	25.0% 2
		Cattle		12.5% 1	37.0% 20	79.8% 87	73.6% 64	80.5% 91	84.0% 63	84.1% 37	81.5% 22	83.3% 25	83.3% 25	74.2% 23
		Swine		0.0% 0	0.0% 0	50.0% 1	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1

Table 36b. Antimicrobial Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	46	77	99	121	124	241	223	191	207	217	220	252	
	Chicken Breasts						0	0	0	0	0	0	0	
	Ground Turkey						3	2	2	3	0	0	3	
	Ground Beef						3	1	2	0	0	0	3	
	Pork Chops						2	1	0	0	0	0	0	
	Chickens	0	1	7	5	8	6	7	0	6	0	3	1	
	Turkeys	0	1	4	6	16	10	19	7	5	4	15	8	
	Cattle	0	8	54	109	87	113	75	44	27	30	30	31	
	Swine	0	1	5	2	7	0	3	0	1	1	1	2	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	0.0% 0	2.6% 2	18.2% 18	22.3% 27	26.6% 33	22.8% 55	21.5% 48	15.2% 29	12.6% 26	12.4% 27	7.7% 17	12.3% 31
		Chicken Breasts												
		Ground Turkey						33.3% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0
		Ground Beef						66.7% 2	100.0% 1	100.0% 2				66.7% 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		50.0% 3		0.0% 0	100.0% 1
		Turkeys		0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	10.5% 2	14.3% 1	0.0% 0	25.0% 1	6.7% 1	25.0% 2
		Cattle		12.5% 1	37.0% 20	76.1% 83	69.0% 60	78.8% 89	81.3% 61	77.3% 34	81.5% 22	76.7% 23	76.7% 23	64.5% 20
		Swine		0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1
Cephems	Cefoxitin (MIC ≥ 32 µg/ml)	Humans				22.3% 27	25.8% 32	22.4% 54	21.5% 48	15.2% 29	12.6% 26	12.9% 28	7.7% 17	12.3% 31
		Chicken Breasts												
		Ground Turkey						33.3% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0
		Ground Beef						66.7% 2	100.0% 1	100.0% 2				66.7% 2
		Pork Chops						100.0% 2	100.0% 1					
		Chickens				0.0% 0	37.5% 3	0.0% 0	71.4% 5		50.0% 3		0.0% 0	100.0% 1
		Turkeys				0.0% 0	12.5% 2	0.0% 0	10.5% 2	14.3% 1	0.0% 0	25.0% 1	6.7% 1	25.0% 2
		Cattle				73.4% 80	66.7% 58	77.9% 88	74.7% 56	77.3% 34	81.5% 22	70.0% 21	76.7% 23	64.5% 20
		Swine				0.0% 0	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1
	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	0.0% 0	1.3% 1	18.2% 18	22.3% 27	27.4% 34	22.8% 55	22.0% 49	15.2% 29	12.6% 26	12.4% 27	7.7% 17	12.3% 31
		Chicken Breasts												
		Ground Turkey						33.3% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0
		Ground Beef						66.7% 2	100.0% 1	100.0% 2				66.7% 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		50.0% 3		0.0% 0	100.0% 1
		Turkeys		0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	10.5% 2	14.3% 1	0.0% 0	25.0% 1	6.7% 1	25.0% 2
		Cattle		12.5% 1	37.0% 20	76.1% 83	69.0% 60	78.8% 89	81.3% 61	77.3% 34	81.5% 22	76.7% 23	76.7% 23	64.5% 20
		Swine		0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1
	Ceftriaxone (MIC ≥ 4 µg/ml) ¹	Humans	0.0% 0	1.3% 1	18.2% 18	22.3% 27	25.8% 32	22.8% 55	21.5% 48	14.7% 28	12.6% 26	12.9% 28	7.7% 17	12.3% 31
		Chicken Breasts												
		Ground Turkey						33.3% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0
		Ground Beef						66.7% 2	100.0% 1	100.0% 2				66.7% 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		50.0% 3		0.0% 0	100.0% 1
		Turkeys		0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	10.5% 2	14.3% 1	0.0% 0	25.0% 1	6.7% 1	25.0% 2
		Cattle		12.5% 1	37.0% 20	76.1% 83	69.0% 60	78.8% 89	81.3% 61	77.3% 34	81.5% 22	76.7% 23	76.7% 23	64.5% 20
		Swine		0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1

¹ Breakpoints for ceftriaxone were revised to reflect those published in CLSI document M100-S20

Table 36c. Antimicrobial Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		
Number of Isolates Tested	Humans	46	77	99	121	124	241	223	191	207	217	220	252		
	Chicken Breasts						0	0	0	0	0	0	0		
	Ground Turkey						3	2	2	3	0	0	3		
	Ground Beef						3	1	2	0	0	0	3		
	Pork Chops						2	1	0	0	0	0	0		
	Chickens	0	1	7	5	8	6	7	0	6	0	3	1		
	Turkeys	0	1	4	6	16	10	19	7	5	4	15	8		
	Cattle	0	8	54	109	87	113	75	44	27	30	30	31		
	Swine	0	1	5	2	7	0	3	0	1	1	1	2		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source													
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole ¹ (MIC ≥ 512 µg/ml)	Humans	4.3%	3.9%	22.2%	23.1%	32.3%	25.7%	24.7%	16.8%	15.5%	15.2%	10.0%	13.1%	
		Chicken Breasts	2	3	22	28	40	62	55	32	32	33	22	33	
		Ground Turkey						33.3%	50.0%	0.0%	0.0%			33.3%	
		Ground Beef						1	1	0	0			1	
		Pork Chops						66.7%	100.0%	100.0%				66.7%	
		Chickens						2	1	2				2	
		Turkeys		100.0%	0.0%	0.0%	37.5%	0.0%	71.4%		50.0%		0.0%	100.0%	
		Cattle		1	0	0	3	0	5		3		0	1	
		Swine		0.0%	0.0%	16.7%	12.5%	0.0%	52.6%	14.3%	80.0%	75.0%	0.0%	37.5%	
			0	0	1	2	0	10	1	4	3	0	3		
			12.5%	35.2%	73.4%	72.4%	74.3%	73.3%	77.3%	85.2%	83.3%	83.3%	74.2%		
			1	19	80	63	84	55	34	23	25	25	23		
			0.0%	0.0%	50.0%	85.7%		100.0%		0.0%	0.0%	0.0%	50.0%		
			0	0	1	6		3		0	0	0	1		
		Trimethoprim- Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	4.3%	1.3%	2.0%	4.1%	1.6%	4.1%	0.9%	2.1%	1.9%	3.2%	1.8%	3.2%
	Chicken Breasts		2	1	2	5	2	10	2	4	4	7	4	8	
	Ground Turkey							33.3%	0.0%	0.0%	0.0%			0.0%	
	Ground Beef							1	0	0	0			0	
Pork Chops							0.0%	0.0%	50.0%				0.0%		
Chickens							0	0	1				0		
Turkeys			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%		0.0%	100.0%		
Cattle			0	0	0	0	0	0	0	1		0	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	0	0	0	0	0			
		0.0%	1.9%	14.7%	12.6%	7.1%	0.0%	11.4%	25.9%	16.7%	13.3%	12.9%			
		0	1	16	11	8	0	5	7	5	4	4			
		0.0%	0.0%	0.0%	0.0%		33.3%		0.0%	0.0%	0.0%	0.0%			
		0	0	0	0		1		0	0	0	0			
Penicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	6.5%	2.6%	18.2%	23.1%	29.8%	24.9%	22.9%	15.7%	14.0%	15.2%	9.5%	14.3%	
		Chicken Breasts	3	2	18	28	37	60	51	30	29	33	21	36	
		Ground Turkey						33.3%	0.0%	0.0%	0.0%			0.0%	
		Ground Beef						1	0	0	0			0	
		Pork Chops						66.7%	100.0%	100.0%				66.7%	
		Chickens						2	1	2				2	
		Turkeys						100.0%	100.0%						
		Cattle		100.0%	0.0%	0.0%	37.5%	16.7%	85.7%		50.0%		0.0%	100.0%	
		Swine		1	0	0	3	1	6		3		0	1	
		0.0%	0.0%	0.0%	12.5%	0.0%	15.8%	28.6%	20.0%	75.0%	6.7%	25.0%			
		0	0	0	2	0	3	2	1	3	1	2			
		12.5%	37.0%	77.1%	70.1%	78.8%	82.7%	81.8%	85.2%	80.0%	76.7%	74.2%			
		1	20	84	61	89	62	36	23	24	23	23			
		0.0%	0.0%	0.0%	85.7%		100.0%		0.0%	0.0%	0.0%	50.0%			
		0	0	0	6		3		0	0	0	1			
Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	4.3%	2.6%	18.2%	23.1%	28.2%	25.3%	22.4%	15.2%	13.5%	12.4%	9.1%	11.9%	
		Chicken Breasts	2	2	18	28	35	61	50	29	28	27	20	30	
		Ground Turkey						33.3%	0.0%	0.0%	0.0%			0.0%	
		Ground Beef						1	0	0	0			0	
		Pork Chops						66.7%	100.0%	100.0%				66.7%	
		Chickens						2	1	2				2	
		Turkeys						100.0%	100.0%						
		Cattle		0.0%	0.0%	0.0%	37.5%	0.0%	85.7%		50.0%		0.0%	100.0%	
		Swine		0	0	0	3	0	6		3		0	1	
		0.0%	0.0%	0.0%	12.5%	0.0%	21.1%	14.3%	0.0%	0.0%	0.0%	12.5%			
		0	0	0	2	0	4	1	0	0	0	1			
		12.5%	37.0%	78.9%	73.6%	77.9%	78.7%	77.3%	81.5%	66.7%	76.7%	64.5%			
		1	20	86	64	88	59	34	22	20	23	20			
		0.0%	0.0%	50.0%	85.7%		100.0%		0.0%	0.0%	0.0%	50.0%			
		0	0	1	6		3		0	0	0	1			

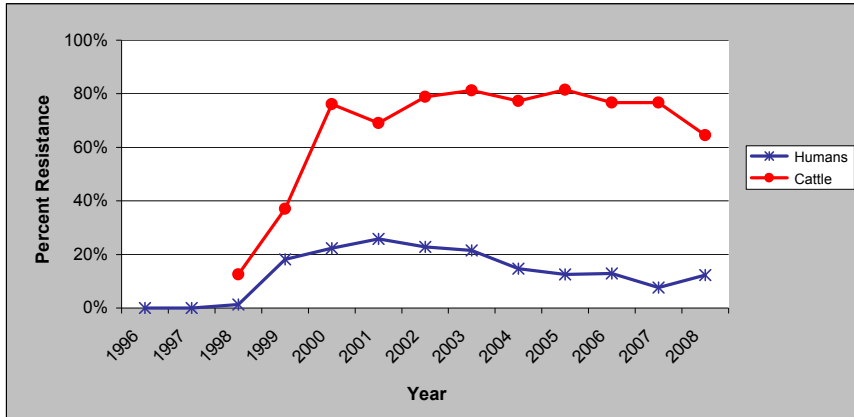
¹ Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

Table 36d. Antimicrobial Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	46	77	99	121	124	241	223	191	207	217	220	252	
	Chicken Breasts						0	0	0	0	0	0	0	
	Ground Turkey						3	2	2	3	0	0	3	
	Ground Beef						3	1	2	0	0	0	3	
	Pork Chops						2	1	0	0	0	0	0	
	Chickens	0	1	7	5	8	6	7	0	6	0	3	1	
	Turkeys	0	1	4	6	16	10	19	7	5	4	15	8	
	Cattle	0	8	54	109	87	113	75	44	27	30	30	31	
	Swine	0	1	5	2	7	0	3	0	1	1	1	2	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
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	0.0% 0	0.0% 0	
		Chicken Breasts												
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0			0.0% 0
		Ground Beef						0.0% 0	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		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	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	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	0.0% 0
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	0.8% 1	0.0% 0	0.8% 2	0.4% 1	0.5% 1	0.0% 0	0.5% 1	0.0% 0	0.4% 1
		Chicken Breasts												
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0			0.0% 0
		Ground Beef						0.0% 0	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		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	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	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	0.0% 0
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	4.3% 2	2.6% 2	19.2% 19	23.1% 28	30.6% 38	25.7% 62	24.2% 54	16.8% 32	14.5% 30	14.3% 31	9.5% 21	13.9% 35
		Chicken Breasts												
		Ground Turkey						33.3% 1	0.0% 0	0.0% 0	0.0% 0			66.7% 2
		Ground Beef						66.7% 2	100.0% 1	100.0% 2				66.7% 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		50.0% 3		0.0% 0	100.0% 1
		Turkeys		0.0% 0	0.0% 0	0.0% 0	12.5% 2	40.0% 4	36.8% 7	28.6% 2	60.0% 3	25.0% 1	20.0% 3	62.5% 5
		Cattle		12.5% 1	38.9% 21	80.7% 88	73.6% 64	80.5% 91	84.0% 63	84.1% 37	81.5% 22	83.3% 25	86.7% 26	74.2% 23
		Swine		100.0% 1	20.0% 1	50.0% 1	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1

Ceftriaxone Resistance

Figure 14. Percent of *Salmonella* Newport Isolates from Humans and Cattle Resistant to Ceftriaxone, by Year, 1996-2008¹



¹ Data for other sources are not included due to the small number of *Salmonella* Newport isolates. Table 36 contains resistance data for *Salmonella* Newport isolates from each source, by year

Table 37. Number of *Salmonella* Newport Isolates Tested from Humans, Retail Meats, and Food Animals, by Year, 1996-2008

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	51	46	77	99	121	124	241	223	191	207	217	220	252
Chicken Breasts							0	0	0	0	0	0	0
Ground Turkey							3	2	2	3	0	0	3
Ground Beef							3	1	2	0	0	0	3
Pork Chops							2	1	0	0	0	0	0
Chickens		0	1	7	5	8	6	7	0	6	0	3	1
Turkeys		0	1	4	6	16	10	19	7	5	4	15	8
Cattle		0	8	54	109	87	113	75	44	27	30	30	31
Swine		0	1	5	2	7	0	3	0	1	1	1	2

Multidrug Resistance

Table 38a. Resistance Patterns among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	46	77	99	121	124	241	223	191	207	217	220	252
	Chicken Breasts						0	0	0	0	0	0	0
	Ground Turkey						3	2	2	3	0	0	3
	Ground Beef						3	1	2	0	0	0	3
	Pork Chops						2	1	0	0	0	0	0
	Chickens	0	1	7	5	8	6	7	0	6	0	3	1
	Turkeys	0	1	4	6	16	10	19	7	5	4	15	8
	Cattle	0	8	54	109	87	113	75	44	27	30	30	31
	Swine	0	1	5	2	7	0	3	0	1	1	1	2
Resistance Pattern	Isolate Source												
1. No Resistance Detected	Humans	93.5% 43	94.8% 73	75.8% 75	75.2% 91	65.3% 81	72.2% 174	73.5% 164	82.2% 157	84.1% 174	82.9% 180	89.5% 197	85.3% 215
	Chicken Breasts												
	Ground Turkey						66.7% 2	50.0% 1	100.0% 2	100.0% 3			0.0% 0
	Ground Beef						33.3% 1	0.0% 0	0.0% 0				33.3% 1
	Pork Chops						0.0% 0	0.0% 0					
	Chickens		0.0% 0	100.0% 7	80.0% 4	62.5% 5	83.3% 5	14.3% 1		50.0% 3		100.0% 3	0.0% 0
	Turkeys		100.0% 1	100.0% 4	83.3% 5	87.5% 14	60.0% 6	21.1% 4	57.1% 4	20.0% 1	25.0% 1	80.0% 12	12.5% 1
	Cattle		87.5% 7	61.1% 33	19.3% 21	25.3% 22	19.5% 22	14.7% 11	15.9% 7	14.8% 4	16.7% 5	13.3% 4	25.8% 8
	Swine		0.0% 0	80.0% 4	50.0% 1	14.3% 1		0.0% 0		100.0% 1	100.0% 1	100.0% 1	50.0% 1
2. Resistant to ≥ 3 Antimicrobial Classes	Humans	4.3% 2	2.6% 2	18.2% 18	23.1% 28	31.5% 39	25.3% 61	23.3% 52	16.2% 31	14.5% 30	15.2% 33	10.5% 23	13.5% 34
	Chicken Breasts												
	Ground Turkey						33.3% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0
	Ground Beef						66.7% 2	100.0% 1	100.0% 2				66.7% 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		50.0% 3		0.0% 0	100.0% 1
	Turkeys		0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	26.3% 5	14.3% 1	80.0% 4	75.0% 3	6.7% 1	37.5% 3
	Cattle		12.5% 1	37.0% 20	79.8% 87	74.7% 65	80.5% 91	84.0% 63	84.1% 37	81.5% 22	83.3% 25	83.3% 25	74.2% 23
	Swine		0.0% 0	0.0% 0	50.0% 1	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1
3. Resistant to ≥ 4 Antimicrobial Classes	Humans	4.3% 2	2.6% 2	18.2% 18	23.1% 28	31.5% 39	25.3% 61	22.9% 51	15.7% 30	14.0% 29	13.4% 29	9.1% 20	13.5% 34
	Chicken Breasts												
	Ground Turkey						33.3% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0
	Ground Beef						66.7% 2	100.0% 1	100.0% 2				66.7% 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		50.0% 3		0.0% 0	100.0% 1
	Turkeys		0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	21.1% 4	14.3% 1	0.0% 0	25.0% 1	6.7% 1	25.0% 2
	Cattle		12.5% 1	37.0% 20	79.8% 87	73.6% 64	80.5% 91	84.0% 63	84.1% 37	81.5% 22	83.3% 25	83.3% 25	74.2% 23
	Swine		0.0% 0	0.0% 0	50.0% 1	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1
4. Resistant to ≥ 5 Antimicrobial Classes	Humans	4.3% 2	2.6% 2	18.2% 18	23.1% 28	26.6% 33	23.7% 57	22.4% 50	14.7% 28	12.6% 26	12.9% 28	8.2% 18	12.7% 32
	Chicken Breasts												
	Ground Turkey						33.3% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0
	Ground Beef						66.7% 2	100.0% 1	100.0% 2				66.7% 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		50.0% 3		0.0% 0	100.0% 1
	Turkeys		0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	10.5% 2	14.3% 1	0.0% 0	25.0% 1	6.7% 1	12.5% 1
	Cattle		12.5% 1	37.0% 20	77.1% 84	69.0% 60	78.8% 89	81.3% 61	79.5% 35	81.5% 22	76.7% 23	76.7% 23	64.5% 20
	Swine		0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1

Table 38b. Resistance Patterns among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	46	77	99	121	124	241	223	191	207	217	220	252
	Chicken Breasts						0	0	0	0	0	0	0
	Ground Turkey						3	2	2	3	0	0	3
	Ground Beef						3	1	2	0	0	0	3
	Pork Chops						2	1	0	0	0	0	0
	Chickens	0	1	7	5	8	6	7	0	6	0	3	1
	Turkeys	0	1	4	6	16	10	19	7	5	4	15	8
	Cattle	0	8	54	109	87	113	75	44	27	30	30	31
	Swine	0	1	5	2	7	0	3	0	1	1	1	2
Resistance Pattern	Isolate Source												
5. At Least ACSSuT¹ Resistant	Humans	4.3% 2	1.3% 1	18.2% 18	23.1% 28	25.8% 32	23.7% 57	22.0% 49	14.7% 28	12.6% 26	12.0% 26	8.2% 18	11.5% 29
	Chicken Breasts												
	Ground Turkey						33.3% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0
	Ground Beef						66.7% 2	100.0% 1	100.0% 2				66.7% 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	71.4% 5		50.0% 3		0.0% 0	100.0% 1
	Turkeys		0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	5.3% 1	14.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Cattle		12.5% 1	35.2% 19	70.6% 77	67.8% 59	70.8% 80	66.7% 50	75.0% 33	81.5% 22	63.3% 19	70.0% 21	64.5% 20
	Swine		0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1
6. At Least ACT/S² Resistant	Humans	4.3% 2	1.3% 1	2.0% 2	4.1% 5	0.8% 1	3.7% 9	0.9% 2	1.0% 2	1.9% 4	2.3% 5	0.5% 1	2.8% 7
	Chicken Breasts												
	Ground Turkey						33.3% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0
	Ground Beef						0.0% 0	0.0% 0	50.0% 1				0.0% 0
	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		16.7% 1		0.0% 0	100.0% 1
	Turkeys		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	14.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Cattle		0.0% 0	1.9% 1	13.8% 15	11.5% 10	7.1% 8	0.0% 0	2.3% 1	25.9% 7	10.0% 3	13.3% 4	12.9% 4
	Swine		0.0% 0	0.0% 0	0.0% 0	0.0% 0		33.3% 1		0.0% 0	0.0% 0	0.0% 0	0.0% 0
7. At Least ACSSuTAuCf³ Resistant	Humans	0.0% 0	1.3% 1	18.2% 18	22.3% 27	25.0% 31	22.8% 55	21.1% 47	14.7% 28	12.6% 26	10.6% 23	7.7% 17	11.5% 29
	Chicken Breasts												
	Ground Turkey						33.3% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0
	Ground Beef						66.7% 2	100.0% 1	100.0% 2				66.7% 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	71.4% 5		50.0% 3		0.0% 0	100.0% 1
	Turkeys		0.0% 0	0.0% 0	0.0% 0	12.5% 2	0.0% 0	5.3% 1	14.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Cattle		12.5% 1	35.2% 19	69.7% 76	66.7% 58	70.8% 80	66.7% 50	72.7% 32	81.5% 22	63.3% 19	70.0% 21	64.5% 20
	Swine		0.0% 0	0.0% 0	0.0% 0	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1
8. At Least Ceftiofur and Nalidixic Acid Resistant	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.4% 1	0.0% 0	0.5% 1	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	0.0% 0			0.0% 0
	Ground Beef						0.0% 0	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		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	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	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	0.0% 0

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

H. Antimicrobial Susceptibility among *Salmonella* Saintpaul

Table 39a. Antimicrobial Resistance among *Salmonella* Saintpaul Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	19	30	35	26	20	53	58	32	41	31	32	108	
	Chicken Breasts						0	2	0	0	0	1	0	
	Ground Turkey						17	24	24	24	19	36	31	
	Ground Beef						0	0	0	1	0	1	1	
	Pork Chops						0	0	0	0	0	1	0	
	Chickens	0	0	3	0	2	2	0	0	0	0	0	0	
	Turkeys	1	18	39	32	29	19	20	16	28	18	29	16	
	Cattle	1	1	5	9	5	5	2	4	1	3	2	0	
	Swine	3	25	22	8	17	18	9	4	11	16	12	6	
	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	0.0% 0	0.0% 0	0.0% 0	
		Chicken Breasts							0.0% 0				0.0% 0	
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
		Ground Beef									0.0% 0		0.0% 0	
		Pork Chops											0.0% 0	
		Chickens			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	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	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Gentamicin (MIC ≥ 16)	Humans	0.0% 0	3.3% 1	2.9% 1	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				100.0% 1	
		Ground Turkey						11.8% 2	45.8% 11	37.5% 9	20.8% 5	26.3% 5	22.2% 8	9.7% 3
		Ground Beef									100.0% 1		0.0% 0	100.0% 1
		Pork Chops											0.0% 0	
		Chickens			33.3% 1		0.0% 0	0.0% 0						
		Turkeys	0.0% 0	55.6% 10	48.7% 19	34.4% 11	31.0% 9	31.6% 6	35.0% 7	43.8% 7	21.4% 6	27.8% 5	20.7% 6	6.3% 1
		Cattle	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	50.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine	0.0% 0	4.0% 1	4.5% 1	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
	Kanamycin (MIC ≥ 64)	Humans	0.0% 0	6.7% 2	5.7% 2	3.8% 1	5.0% 1	0.0% 0	5.2% 3	6.3% 2	2.4% 1	3.2% 1	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0				0.0% 0	
		Ground Turkey						11.8% 2	58.3% 14	45.8% 11	54.2% 13	15.8% 3	13.9% 5	3.2% 1
		Ground Beef									100.0% 1		0.0% 0	0.0% 0
		Pork Chops											0.0% 0	
		Chickens			0.0% 0		0.0% 0	0.0% 0						
		Turkeys	0.0% 0	66.7% 12	53.8% 21	43.8% 14	44.8% 13	36.8% 7	50.0% 10	56.3% 9	53.6% 15	27.8% 5	17.2% 5	6.3% 1
		Cattle	0.0% 0	0.0% 0	0.0% 0	0.0% 0	20.0% 1	0.0% 0	50.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine	0.0% 0	4.0% 1	4.5% 1	0.0% 0	5.9% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Streptomycin (MIC ≥ 64)	Humans	5.3% 1	10.0% 3	5.7% 2	7.7% 2	5.0% 1	0.0% 0	6.9% 4	6.3% 2	2.4% 1	6.5% 2	0.0% 0	1.9% 2
		Chicken Breasts							50.0% 1				100.0% 1	
		Ground Turkey						23.5% 4	62.5% 15	54.2% 13	41.7% 10	15.8% 3	27.8% 10	25.8% 8
		Ground Beef									100.0% 1		0.0% 0	100.0% 1
		Pork Chops											100.0% 1	
		Chickens			33.3% 1		100.0% 2	0.0% 0						
		Turkeys	0.0% 0	61.1% 11	48.7% 19	31.3% 10	58.6% 17	36.8% 7	40.0% 8	62.5% 10	28.6% 8	38.9% 7	6.9% 2	0.0% 0
		Cattle	0.0% 0	0.0% 0	0.0% 0	0.0% 0	20.0% 1	0.0% 0	50.0% 1	25.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine	0.0% 0	4.0% 1	4.5% 1	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

Table 39b. Antimicrobial Resistance among *Salmonella* Saintpaul Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	19	30	35	26	20	53	58	32	41	31	32	108	
	Chicken Breasts						0	2	0	0	0	1	0	
	Ground Turkey						17	24	24	24	19	36	31	
	Ground Beef						0	0	0	1	0	1	1	
	Pork Chops						0	0	0	0	0	1	0	
	Chickens	0	0	3	0	2	2	0	0	0	0	0	0	
	Turkeys	1	18	39	32	29	19	20	16	28	18	29	16	
	Cattle	1	1	5	9	5	5	2	4	1	3	2	0	
	Swine	3	25	22	8	17	18	9	4	11	16	12	6	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	0.0% 0	3.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.2% 1	3.1% 1	3.7% 4
		Chicken Breasts							0.0% 0				0.0% 0	
		Ground Turkey						17.7% 3	29.2% 7	16.7% 4	4.2% 1	0.0% 0	2.8% 1	0.0% 0
		Ground Beef									0.0% 0		0.0% 0	0.0% 0
		Pork Chops											0.0% 0	
		Chickens			0.0% 0		0.0% 0	0.0% 0						
		Turkeys	0.0% 0	0.0% 0	2.6% 1	6.3% 2	10.3% 3	0.0% 0	5.0% 1	0.0% 0	0.0% 0	5.6% 1	13.8% 4	0.0% 0
		Cattle	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	50.0% 1	50.0% 2	0.0% 0	33.3% 1	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Cephems	Cefoxitin (MIC ≥ 32 µg/ml)	Humans				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.2% 1	3.1% 1	3.7% 4
		Chicken Breasts							0.0% 0				0.0% 0	
		Ground Turkey						0.0% 0	0.0% 0	4.2% 1	0.0% 0	0.0% 0	2.8% 1	0.0% 0
		Ground Beef									0.0% 0		0.0% 0	0.0% 0
		Pork Chops											0.0% 0	
		Chickens					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	5.6% 1	10.3% 3	0.0% 0
		Cattle				0.0% 0	0.0% 0	0.0% 0	50.0% 1	50.0% 2	0.0% 0	33.3% 1	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	0.0% 0
	Ceftiofur (MIC ≥ 8 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	3.2% 1	3.1% 1	3.7% 4
		Chicken Breasts							0.0% 0				0.0% 0	
		Ground Turkey						0.0% 0	0.0% 0	4.2% 1	0.0% 0	0.0% 0	2.8% 1	0.0% 0
		Ground Beef									0.0% 0		0.0% 0	0.0% 0
		Pork Chops											0.0% 0	
		Chickens			0.0% 0		0.0% 0	0.0% 0						
		Turkeys	0.0% 0	0.0% 0	5.1% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	5.6% 1	13.8% 4	0.0% 0
		Cattle	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	50.0% 1	50.0% 2	0.0% 0	33.3% 1	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ceftriaxone (MIC ≥ 4 µg/ml) ¹	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	3.2% 1	3.1% 1	3.7% 4
		Chicken Breasts							0.0% 0				0.0% 0	
		Ground Turkey						0.0% 0	0.0% 0	8.3% 2	0.0% 0	0.0% 0	5.6% 2	0.0% 0
		Ground Beef									0.0% 0		0.0% 0	0.0% 0
		Pork Chops											0.0% 0	
		Chickens			0.0% 0		0.0% 0	0.0% 0						
		Turkeys	0.0% 0	0.0% 0	2.6% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	5.6% 1	13.8% 4	0.0% 0
		Cattle	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	50.0% 1	50.0% 2	0.0% 0	33.3% 1	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0

¹ Breakpoints for ceftriaxone were revised to reflect those published in CLSI document M100-S20

Table 39c. Antimicrobial Resistance among *Salmonella* Saintpaul Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		
Number of Isolates Tested	Humans	19	30	35	26	20	53	58	32	41	31	32	108		
	Chicken Breasts						0	2	0	0	0	1	0		
	Ground Turkey						17	24	24	24	19	36	31		
	Ground Beef						0	0	0	1	0	1	1		
	Pork Chops						0	0	0	0	0	1	0		
	Chickens	0	0	3	0	2	2	0	0	0	0	0	0		
	Turkeys	1	18	39	32	29	19	20	16	28	18	29	16		
	Cattle	1	1	5	9	5	5	2	4	1	3	2	0		
	Swine	3	25	22	8	17	18	9	4	11	16	12	6		
	Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Folate Pathway Inhibitors	Sulfamethoxazole/Sulfisoxazole ¹ (MIC ≥ 512 µg/ml)	Humans	0.0% 0	16.7% 5	17.1% 6	11.5% 3	15.0% 3	0.0% 0	8.6% 5	0.0% 0	0.0% 0	0.0% 0	1.9% 2		
		Chicken Breasts							50.0% 1				100.0% 1		
		Ground Turkey						23.5% 4	70.8% 17	54.2% 13	62.5% 15	26.3% 5	36.1% 13	16.1% 5	
		Ground Beef									100.0% 1		0.0% 0	100.0% 1	
		Pork Chops											100.0% 1		
		Chickens			33.3% 1		0.0% 0	0.0% 0							
		Turkeys	0.0% 0	61.1% 11	69.2% 27	53.1% 17	79.3% 23	47.4% 9	75.0% 15	93.8% 15	53.6% 15	61.1% 11	31.0% 9	6.3% 1	
		Cattle	0.0% 0	0.0% 0	0.0% 0	11.1% 1	20.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0		
		Swine	0.0% 0	8.0% 2	4.5% 1	0.0% 0	0.0% 0	0.0% 0	11.1% 1	0.0% 0	0.0% 0	6.3% 1	0.0% 0	0.0% 0	
		Trimethoprim-Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	0.0% 0	6.7% 2	8.6% 3	0.0% 0	0.0% 0	0.0% 0	3.4% 2	0.0% 0	2.4% 1	3.2% 1	3.1% 1	0.0% 0
	Chicken Breasts								0.0% 0				0.0% 0		
	Ground Turkey							0.0% 0	0.0% 0	0.0% 0	0.0% 0	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		
	Chickens				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	0.0% 0	0.0% 0	3.4% 1	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	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
	Penicillins		Ampicillin (MIC ≥ 32 µg/ml)	Humans	0.0% 0	10.0% 3	5.7% 2	7.7% 2	10.0% 2	0.0% 0	3.4% 2	6.3% 2	4.9% 2	9.7% 3	9.4% 3
		Chicken Breasts								50.0% 1				100.0% 1	
Ground Turkey								23.5% 4	66.7% 16	50.0% 12	58.3% 14	31.6% 6	44.4% 16	41.9% 13	
Ground Beef											100.0% 1		0.0% 0	0.0% 0	
Pork Chops													100.0% 1		
Chickens					0.0% 0		0.0% 0	0.0% 0							
Turkeys		0.0% 0		22.2% 4	33.3% 13	50.0% 16	62.1% 18	47.4% 9	75.0% 15	93.8% 15	46.4% 13	55.6% 10	31.0% 9	18.8% 3	
Cattle		0.0% 0		0.0% 0	0.0% 0	22.2% 2	0.0% 0	0.0% 0	50.0% 1	50.0% 2	0.0% 0	33.3% 1	0.0% 0		
Swine		0.0% 0		4.0% 1	0.0% 0	0.0% 0	5.9% 1	0.0% 0	11.1% 1	0.0% 0	0.0% 0	6.3% 1	0.0% 0	0.0% 0	
Phenicol		Chloramphenicol (MIC ≥ 32 µg/ml)		Humans	0.0% 0	3.3% 1	2.9% 1	3.8% 1	10.0% 2	0.0% 0	0.0% 0	0.0% 0	2.4% 1	3.2% 1	0.0% 0
	Chicken Breasts								0.0% 0				0.0% 0		
	Ground Turkey							0.0% 0	0.0% 0	4.2% 1	0.0% 0	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		
	Chickens				0.0% 0		0.0% 0	0.0% 0							
	Turkeys		0.0% 0	0.0% 0	2.6% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.4% 1	0.0% 0	
	Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	50.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0		
	Swine		0.0% 0	0.0% 0	4.5% 1	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	

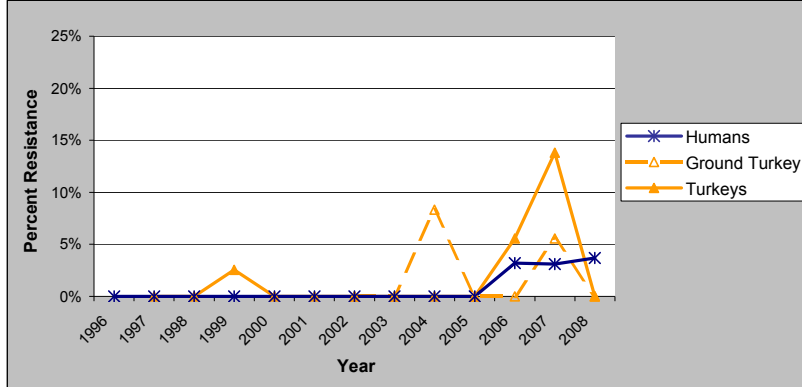
¹ Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

Table 39d. Antimicrobial Resistance among *Salmonella* Saintpaul Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	19	30	35	26	20	53	58	32	41	31	32	108	
	Chicken Breasts						0	2	0	0	0	1	0	
	Ground Turkey						17	24	24	24	19	36	31	
	Ground Beef						0	0	0	1	0	1	1	
	Pork Chops						0	0	0	0	0	1	0	
	Chickens	0	0	3	0	2	2	0	0	0	0	0	0	
	Turkeys	1	18	39	32	29	19	20	16	28	18	29	16	
	Cattle	1	1	5	9	5	5	2	4	1	3	2	0	
	Swine	3	25	22	8	17	18	9	4	11	16	12	6	
	Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source											
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	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							0.0% 0				0.0% 0	
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0	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	
		Chickens			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	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	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	5.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.9% 1	1.7% 1	3.1% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts							50.0% 1				0.0% 0	
		Ground Turkey						23.5% 4	16.7% 4	0.0% 0	0.0% 0	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	
		Chickens			0.0% 0		0.0% 0	0.0% 0						
		Turkeys	0.0% 0	0.0% 0	0.0% 0	3.1% 1	20.6% 6	21.1% 4	0.0% 0	6.3% 1	3.6% 1	5.6% 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	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	5.3% 1	16.7% 5	5.7% 2	7.7% 2	10.0% 2	3.8% 2	15.5% 9	12.5% 4	22.0% 9	22.6% 7	25.0% 8	4.6% 5
		Chicken Breasts							0.0% 0				100.0% 1	
		Ground Turkey						94.1% 16	20.8% 5	58.3% 14	33.3% 8	73.7% 14	61.1% 22	67.7% 21
		Ground Beef									0.0% 0		0.0% 0	100.0% 1
		Pork Chops											100.0% 1	
		Chickens			0.0% 0		100.0% 2	0.0% 0						
		Turkeys	0.0% 0	83.3% 15	51.3% 20	62.5% 20	48.3% 14	57.9% 11	20.0% 4	18.8% 3	42.9% 12	55.6% 10	44.8% 13	81.3% 13
		Cattle	0.0% 0	0.0% 0	0.0% 0	33.3% 3	20.0% 1	0.0% 0	50.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
		Swine	33.3% 1	12.0% 3	18.2% 4	0.0% 0	17.6% 3	5.6% 1	22.2% 2	0.0% 0	0.0% 0	6.3% 1	0.0% 0	0.0% 0

Ceftriaxone Resistance

Figure 15. Percent of *Salmonella* Saintpaul Isolates from Humans Resistant to Ceftriaxone, by Year, 1996-2008¹



¹ Data for other sources are not included due to the small number of *Salmonella* Saintpaul isolates. Table 39 contains resistance data for *Salmonella* Saintpaul isolates from each source, by year

Table 40. Number of *Salmonella* Saintpaul Isolates Tested from Humans, Retail Meats, and Food Animals, by Year, 1996-2008

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	17	19	30	35	26	20	53	58	32	41	31	32	108
Chicken Breasts							0	2	0	0	0	1	0
Ground Turkey							17	24	24	24	19	36	31
Ground Beef							0	0	0	1	0	1	1
Pork Chops							0	0	0	0	0	1	0
Chickens		0	0	3	0	2	2	0	0	0	0	0	0
Turkeys		1	18	39	32	29	19	20	16	28	18	29	16
Cattle		1	1	5	9	5	5	2	4	1	3	2	0
Swine		3	25	22	8	17	18	9	4	11	16	12	6

Multidrug Resistance

Table 41a. Resistance Patterns among *Salmonella* Saintpaul Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	19	30	35	26	20	53	58	32	41	31	32	108
	Chicken Breasts						0	2	0	0	0	1	0
	Ground Turkey						17	24	24	19	19	36	31
	Ground Beef						0	0	0	1	0	1	1
	Pork Chops						0	0	0	0	0	1	0
	Chickens	0	0	3	0	2	2	0	0	0	0	0	0
	Turkeys	1	18	39	32	29	19	20	16	28	18	29	16
	Cattle	1	1	5	9	5	5	2	4	1	3	2	0
	Swine	3	25	22	8	17	18	9	4	11	16	12	6
	Resistance Pattern	Isolate Source											
1. No Resistance Detected	Humans	84.2% 16	80.0% 24	82.9% 29	84.6% 22	85.0% 17	94.3% 50	74.1% 43	78.1% 25	70.7% 29	71.0% 22	71.9% 23	90.7% 98
	Chicken Breasts							50.0% 1				0.0% 0	
	Ground Turkey						0.0% 0	12.5% 3	0.0% 0	16.7% 4	5.3% 1	25.0% 9	29.0% 9
	Ground Beef									0.0% 0		100.0% 1	0.0% 0
	Pork Chops											0.0% 0	
	Chickens			66.7% 2		0.0% 0	100.0% 2						
	Turkeys	100.0% 1	11.1% 2	15.4% 6	9.4% 3	3.4% 1	0.0% 0	5.0% 1	6.3% 1	14.3% 4	5.6% 1	34.5% 10	18.8% 3
	Cattle	100.0% 1	100.0% 1	100.0% 5	66.7% 6	80.0% 4	100.0% 5	50.0% 1	50.0% 2	100.0% 1	66.7% 2	100.0% 2	
	Swine	66.7% 2	88.0% 22	77.3% 17	100.0% 8	82.4% 14	94.4% 17	77.8% 7	100.0% 4	100.0% 11	87.5% 14	100.0% 12	100.0% 6
	2. Resistant to ≥ 3 Antimicrobial Classes	Humans	0.0% 0	10.0% 3	8.6% 3	11.5% 3	15.0% 3	0.0% 0	5.2% 3	6.3% 2	4.9% 2	9.7% 3	3.1% 1
Chicken Breasts								50.0% 1				100.0% 1	
Ground Turkey							23.5% 4	66.7% 16	54.2% 13	62.5% 15	26.3% 5	36.1% 13	29.0% 9
Ground Beef										100.0% 1		0.0% 0	100.0% 1
Pork Chops												100.0% 1	
Chickens				0.0% 0		0.0% 0	0.0% 0						
Turkeys		0.0% 0	61.1% 11	64.1% 25	53.1% 17	72.4% 21	47.4% 9	55.0% 11	87.5% 14	50.0% 14	66.7% 12	34.5% 10	12.5% 2
Cattle		0.0% 0	0.0% 0	0.0% 0	11.1% 1	20.0% 1	0.0% 0	50.0% 1	50.0% 2	0.0% 0	33.3% 1	0.0% 0	
Swine		0.0% 0	8.0% 2	4.5% 1	0.0% 0	5.9% 1	0.0% 0	11.1% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
3. Resistant to ≥ 4 Antimicrobial Classes		Humans	0.0% 0	6.7% 2	2.9% 1	3.8% 1	10.0% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.2% 1	3.1% 1
	Chicken Breasts							50.0% 1				100.0% 1	
	Ground Turkey						23.5% 4	66.7% 16	25.0% 6	12.5% 3	5.3% 1	19.4% 7	3.2% 1
	Ground Beef									0.0% 0		0.0% 0	0.0% 0
	Pork Chops											100.0% 1	
	Chickens			0.0% 0		0.0% 0	0.0% 0						
	Turkeys	0.0% 0	5.6% 1	2.6% 1	28.1% 9	37.9% 11	10.5% 2	5.0% 1	25.0% 4	10.7% 3	22.2% 4	10.3% 3	0.0% 0
	Cattle	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	50.0% 1	25.0% 1	0.0% 0	0.0% 0	0.0% 0	
	Swine	0.0% 0	4.0% 1	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	0.0% 0
	4. Resistant to ≥ 5 Antimicrobial Classes	Humans	0.0% 0	3.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.2% 1	0.0% 0
Chicken Breasts								50.0% 1				0.0% 0	
Ground Turkey							23.5% 4	41.7% 10	4.2% 1	0.0% 0	0.0% 0	2.8% 1	0.0% 0
Ground Beef										0.0% 0		0.0% 0	0.0% 0
Pork Chops												0.0% 0	
Chickens				0.0% 0		0.0% 0	0.0% 0						
Turkeys		0.0% 0	0.0% 0	2.6% 1	3.1% 1	3.4% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	5.6% 1	6.9% 2	0.0% 0
Cattle		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	50.0% 1	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0

Table 41b. Resistance Patterns among *Salmonella* Saintpaul Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	19	30	35	26	20	53	58	32	41	31	32	108
	Chicken Breasts						0	2	0	0	0	1	0
	Ground Turkey						17	24	24	24	19	36	31
	Ground Beef						0	0	0	1	0	1	1
	Pork Chops						0	0	0	0	0	1	0
	Chickens	0	0	3	0	2	2	0	0	0	0	0	0
	Turkeys	1	18	39	32	29	19	20	16	28	18	29	16
	Cattle	1	1	5	9	5	5	2	4	1	3	2	0
	Swine	3	25	22	8	17	18	9	4	11	16	12	6
Resistance Pattern	Isolate Source												
5. At Least ACSSuT¹ 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	3.2% 1	0.0% 0	0.9% 1
	Chicken Breasts							0.0% 0				0.0% 0	
	Ground Turkey						0.0% 0	0.0% 0	4.2% 1	0.0% 0	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	
	Chickens			0.0% 0		0.0% 0	0.0% 0						
	Turkeys	0.0% 0	0.0% 0	2.6% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.4% 1	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	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
6. At Least ACT/S² 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	0.0% 0	0.0% 0	0.0% 0
	Chicken Breasts							0.0% 0				0.0% 0	
	Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0	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	
	Chickens			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	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	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
7. At Least ACSSuTAuCf³ 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	3.2% 1	0.0% 0	0.9% 1
	Chicken Breasts							0.0% 0				0.0% 0	
	Ground Turkey						0.0% 0	0.0% 0	4.2% 1	0.0% 0	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	
	Chickens			0.0% 0		0.0% 0	0.0% 0						
	Turkeys	0.0% 0	0.0% 0	2.6% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.4% 1	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	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
8. 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	0.0% 0	0.0% 0	0.0% 0
	Chicken Breasts							0.0% 0				0.0% 0	
	Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0	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	
	Chickens			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	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	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	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

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

I. Antimicrobial Susceptibility among *Salmonella* I 4,[5],12:i:-

Table 42a. Antimicrobial Resistance among *Salmonella* I 4,[5],12:i:- Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	3	0	8	13	14	35	37	36	33	105	73	83	
	Chicken Breasts						5	2	4	9	9	2	4	
	Ground Turkey						2	0	0	0	2	0	0	
	Ground Beef						0	0	0	0	0	2	0	
	Pork Chops						0	0	0	0	0	0	0	
	Chickens	N/A ¹	N/A	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29
	Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0
	Cattle	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1
	Swine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	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	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0				0.0% 0		
		Ground Beef											0.0% 0	
		Pork Chops												
		Chickens								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	
		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
	Gentamicin (MIC ≥ 16 µg/ml)	Humans	0.0% 0		0.0% 0	0.0% 0	7.1% 1	0.0% 0	5.4% 2	5.6% 2	0.0% 0	4.8% 5	1.4% 1	3.6% 3
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	11.1% 1	22.2% 2	50.0% 1	0.0% 0
		Ground Turkey						0.0% 0				50.0% 1		
		Ground Beef											50.0% 1	
		Pork Chops												
		Chickens								11.4% 5	9.8% 10	11.4% 9	0.0% 0	6.9% 2
		Turkeys								100.0% 1	0.0% 0	100.0% 1	100.0% 1	
		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
	Kanamycin (MIC ≥ 64 µg/ml)	Humans	0.0% 0		0.0% 0	0.0% 0	7.1% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.4% 1	1.2% 1
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0				0.0% 0		
		Ground Beef											0.0% 0	
		Pork Chops												
		Chickens								4.5% 2	0.0% 0	0.0% 0	4.1% 2	0.0% 0
		Turkeys								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
		Swine									0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Streptomycin (MIC ≥ 64 µg/ml)	Humans	66.7% 2		0.0% 0	7.7% 1	14.3% 2	2.9% 1	8.1% 3	5.6% 2	3.0% 1	3.8% 4	8.2% 6	10.8% 9
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	11.1% 1	22.2% 2	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0				50.0% 1		
		Ground Beef											0.0% 0	
		Pork Chops												
		Chickens								15.9% 7	9.8% 10	6.3% 5	8.2% 4	10.3% 3
		Turkeys								100.0% 1	50.0% 1	100.0% 1	100.0% 1	
		Cattle								25.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine									100.0% 1	0.0% 0	0.0% 0	100.0% 1

¹ N/A = data not available. Antigenic formulas for monophasic *Salmonella* were not determined for food animal isolates prior to 2004

Table 42b. Antimicrobial Resistance among *Salmonella* I 4,[5],12:i:- Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	3	0	8	13	14	35	37	36	33	105	73	83	
	Chicken Breasts						5	2	4	9	9	2	4	
	Ground Turkey						2	0	0	0	2	0	0	
	Ground Beef						0	0	0	0	0	2	0	
	Pork Chops						0	0	0	0	0	0	0	
	Chickens	N/A ¹	N/A	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29
	Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0
	Cattle	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1
	Swine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	1
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	0.0% 0		0.0% 0	0.0% 0	0.0% 0	2.9% 1	5.4% 2	2.8% 1	3.0% 1	3.8% 4	1.4% 1	3.6% 3
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	11.1% 1	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0				0.0% 0		
		Ground Beef											0.0% 0	
		Pork Chops												
		Chickens								4.5% 2	5.9% 6	16.5% 13	16.3% 8	3.4% 1
		Turkeys								0.0% 0	50.0% 1	0.0% 0	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
		Cephems	Cefoxitin (MIC ≥ 32 µg/ml)	Humans					0.0% 0	2.9% 1	5.4% 2	2.8% 1	3.0% 1	3.8% 4
Chicken Breasts								0.0% 0	0.0% 0	0.0% 0	0.0% 0	11.1% 1	0.0% 0	0.0% 0
Ground Turkey								0.0% 0				0.0% 0		
Ground Beef													0.0% 0	
Pork Chops														
Chickens										4.5% 2	5.9% 6	16.5% 13	16.3% 8	3.4% 1
Turkeys										0.0% 0	50.0% 1	0.0% 0	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
Cephems	Ceftiofur (MIC ≥ 8 µg/ml)			Humans	0.0% 0		0.0% 0	0.0% 0	7.1% 1	2.9% 1	5.4% 2	2.8% 1	3.0% 1	3.8% 4
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	11.1% 1	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0				0.0% 0		
		Ground Beef											0.0% 0	
		Pork Chops												
		Chickens								4.5% 2	5.9% 6	16.5% 13	16.3% 8	3.4% 1
		Turkeys								0.0% 0	50.0% 1	0.0% 0	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
		Cephems	Ceftriaxone (MIC ≥ 4 µg/ml) ²	Humans	0.0% 0		0.0% 0	0.0% 0	0.0% 0	2.9% 1	5.4% 2	2.8% 1	3.0% 1	3.8% 4
Chicken Breasts								0.0% 0	0.0% 0	0.0% 0	0.0% 0	11.1% 1	0.0% 0	0.0% 0
Ground Turkey								0.0% 0				0.0% 0		
Ground Beef													0.0% 0	
Pork Chops														
Chickens										4.5% 2	5.9% 6	16.5% 13	16.3% 8	3.4% 1
Turkeys										0.0% 0	50.0% 1	0.0% 0	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

¹ N/A = data not available. Antigenic formulas for monophasic *Salmonella* were not determined for food animal isolates prior to 2004

² Breakpoints for ceftriaxone were revised to reflect those published in CLSI document M100-S20

Table 42c. Antimicrobial Resistance among *Salmonella* I 4,[5],12:i:- Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	3	0	8	13	14	35	37	36	33	105	73	83	
	Chicken Breasts						5	2	4	9	9	2	4	
	Ground Turkey						2	0	0	0	2	0	0	
	Ground Beef						0	0	0	0	0	2	0	
	Pork Chops						0	0	0	0	0	0	0	
	Chickens	N/A ¹	N/A	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29
	Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0
	Cattle	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1
	Swine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	1
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole ² (MIC ≥ 512 µg/ml)	Humans	100.0% 3		12.5% 1	0.0% 0	14.3% 2	2.9% 1	5.4% 2	11.1% 4	0.0% 0	8.6% 9	4.1% 3	13.3% 11
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	11.1% 1	22.2% 2	50.0% 1	0.0% 0
		Ground Turkey						0.0% 0				50.0% 1		
		Ground Beef											50.0% 1	
		Pork Chops												
		Chickens								13.6% 6	9.8% 10	13.9% 11	6.1% 3	6.9% 2
		Turkeys								100.0% 1	50.0% 1	100.0% 1	100.0% 1	
		Cattle								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine									100.0% 1	50.0% 1	0.0% 0	100.0% 1
Trimethoprim-Sulfamethoxazole	(MIC ≥ 4 / 76 µg/ml)	Humans	0.0% 0		0.0% 0	0.0% 0	7.1% 1	2.9% 1	0.0% 0	2.8% 1	0.0% 0	0.0% 0	1.4% 1	4.8% 4
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0				0.0% 0		
		Ground Beef											0.0% 0	
		Pork Chops												
		Chickens								4.5% 2	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	
		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
Penicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	0.0% 0		0.0% 0	7.7% 1	7.1% 1	8.6% 3	8.1% 3	5.6% 2	6.1% 2	6.7% 7	5.5% 4	8.4% 7
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	11.1% 1	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0				0.0% 0		
		Ground Beef											0.0% 0	
		Pork Chops												
		Chickens								6.8% 3	8.8% 9	17.7% 14	20.4% 10	6.9% 2
		Turkeys								0.0% 0	50.0% 1	0.0% 0	0.0% 0	
		Cattle								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine									100.0% 1	50.0% 1	0.0% 0	100.0% 1
Phenicols	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	0.0% 0		0.0% 0	0.0% 0	7.1% 1	2.9% 1	0.0% 0	2.8% 1	0.0% 0	1.9% 2	1.4% 1	6.0% 5
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0				0.0% 0		
		Ground Beef											0.0% 0	
		Pork Chops												
		Chickens								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	
		Cattle								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine									0.0% 0	50.0% 1	0.0% 0	100.0% 1

¹ N/A = data not available. Antigenic formulas for monophasic *Salmonella* were not determined for food animal isolates prior to 2004

² Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

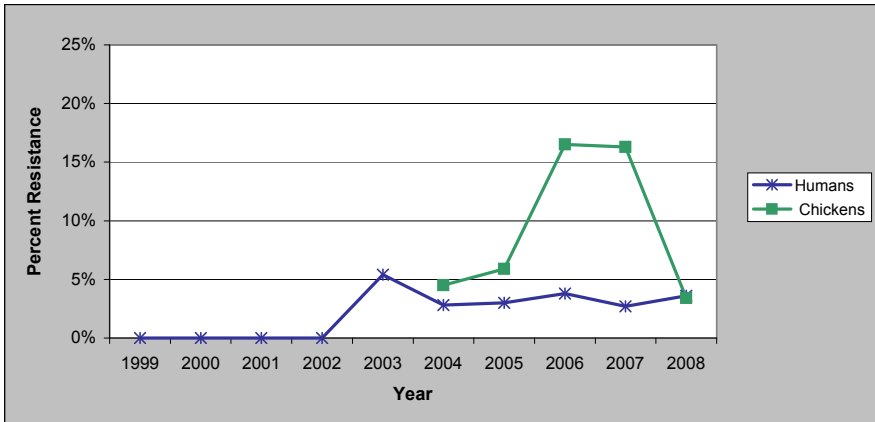
Table 42d. Antimicrobial Resistance among *Salmonella* 14,[5],12:i:- Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	3	0	8	13	14	35	37	36	33	105	73	83	
	Chicken Breasts						5	2	4	9	9	2	4	
	Ground Turkey						2	0	0	0	2	0	0	
	Ground Beef						0	0	0	0	0	2	0	
	Pork Chops						0	0	0	0	0	0	0	
	Chickens	N/A ¹	N/A	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29
	Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0
	Cattle	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1
	Swine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	1
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
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	0.0% 0	0.0% 0
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0				0.0% 0		
		Ground Beef											0.0% 0	
		Pork Chops												
		Chickens								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	
		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
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	0.0% 0		0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.7% 1	2.8% 1	0.0% 0	1.0% 1	1.4% 1	1.2% 1
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0				0.0% 0		
		Ground Beef											0.0% 0	
		Pork Chops												
		Chickens								2.3% 1	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	
		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
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	0.0% 0		0.0% 0	7.7% 1	7.1% 1	5.7% 2	0.0% 0	11.1% 4	3.0% 1	8.6% 9	9.6% 7	16.9% 14
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	11.1% 1	11.1% 1	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0				0.0% 0		
		Ground Beef											0.0% 0	
		Pork Chops												
		Chickens								11.4% 5	4.9% 5	3.8% 3	14.3% 7	3.4% 1
		Turkeys								0.0% 0	50.0% 1	0.0% 0	0.0% 0	
		Cattle								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Swine									100.0% 1	50.0% 1	0.0% 0	100.0% 1

¹ N/A = data not available. Antigenic formulas for monophasic *Salmonella* were not determined for food animal isolates prior to 2004

Ceftriaxone Resistance

Figure 16. Percent of *Salmonella* I 4,[5],12:i:- Isolates from Humans and Chickens Resistant to Ceftriaxone, by Year, 1999-2008 ¹



¹ Data for other sources and data for humans for 1996-1998 are not included due to the small number of *Salmonella* I 4,[5],12:i:- isolates. Data for food animals are not available for this serotype prior to 2004. Table 42 contains all resistance data available for *Salmonella* I 4,[5],12:i:- isolates

Table 43. Number of *Salmonella* I 4,[5],12:i:- Isolates Tested from Humans, Retail Meats, and Food Animals, by Year, 1996-2008

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	3	3	0	8	13	14	35	37	36	33	105	73	83
Chicken Breasts							5	2	4	9	9	2	4
Ground Turkey							2	0	0	0	2	0	0
Ground Beef							0	0	0	0	0	2	0
Pork Chops							0	0	0	0	0	0	0
Chickens		N/A ¹	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29
Turkeys		N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0
Cattle		N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1
Swine		N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	1

¹ N/A = data not available. Antigenic formulas for monophasic *Salmonella* were not determined for food animal isolates prior to 2004

Multidrug Resistance

Table 44a. Resistance Patterns among *Salmonella* I 4,[5],12:i:- Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	3	0	8	13	14	35	37	36	33	105	73	83
	Chicken Breasts						5	2	4	9	9	2	4
	Ground Turkey						2	0	0	0	2	0	0
	Ground Beef						0	0	0	0	0	2	0
	Pork Chops						0	0	0	0	0	0	0
	Chickens	N/A ¹	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29
	Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0
	Cattle	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1
	Swine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	1
Resistance Pattern	Isolate Source												
1. No Resistance Detected	Humans	0.0% 0		87.5% 7	92.3% 12	78.6% 11	91.4% 32	78.4% 29	80.6% 29	87.9% 29	85.7% 90	82.2% 60	77.1% 64
	Chicken Breasts						100.0% 5	100.0% 2	100.0% 4	88.9% 8	55.6% 5	50.0% 1	100.0% 4
	Ground Turkey						100.0% 2				50.0% 1		
	Ground Beef											50.0% 1	
	Pork Chops												
	Chickens								77.3% 34	76.5% 78	68.4% 54	65.3% 32	82.8% 24
	Turkeys								0.0% 0	50.0% 1	0.0% 0	0.0% 0	
	Cattle								75.0% 3	100.0% 2	100.0% 3	100.0% 6	100.0% 1
	Swine									0.0% 0	50.0% 1	100.0% 1	0.0% 0
2. Resistant to ≥ 3 Antimicrobial Classes	Humans	0.0% 0		0.0% 0	7.7% 1	7.1% 1	5.7% 2	5.4% 2	8.3% 3	3.0% 1	9.5% 10	5.5% 4	9.6% 8
	Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	11.1% 1	22.2% 2	0.0% 0	0.0% 0
	Ground Turkey						0.0% 0				0.0% 0		
	Ground Beef											0.0% 0	
	Pork Chops												
	Chickens								13.6% 6	9.8% 10	19.0% 15	20.4% 10	6.9% 2
	Turkeys								0.0% 0	50.0% 1	0.0% 0	0.0% 0	
	Cattle								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Swine									100.0% 1	50.0% 1	0.0% 0	100.0% 1
3. Resistant to ≥ 4 Antimicrobial Classes	Humans	0.0% 0		0.0% 0	0.0% 0	7.1% 1	2.9% 1	0.0% 0	2.8% 1	0.0% 0	3.8% 4	2.7% 2	7.2% 6
	Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Turkey						0.0% 0				0.0% 0		
	Ground Beef											0.0% 0	
	Pork Chops												
	Chickens								2.3% 1	0.0% 0	1.3% 1	0.0% 0	0.0% 0
	Turkeys								0.0% 0	50.0% 1	0.0% 0	0.0% 0	
	Cattle								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Swine									100.0% 1	50.0% 1	0.0% 0	100.0% 1
4. Resistant to ≥ 5 Antimicrobial Classes	Humans	0.0% 0		0.0% 0	0.0% 0	7.1% 1	2.9% 1	0.0% 0	2.8% 1	0.0% 0	2.9% 3	1.4% 1	4.8% 4
	Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Turkey						0.0% 0				0.0% 0		
	Ground Beef											0.0% 0	
	Pork Chops												
	Chickens								2.3% 1	0.0% 0	1.3% 1	0.0% 0	0.0% 0
	Turkeys								0.0% 0	50.0% 1	0.0% 0	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	100.0% 1

¹ N/A = data not available. Antigenic formulas for monophasic *Salmonella* were not determined for food animal isolates prior to 2004

Table 44b. Resistance Patterns among *Salmonella* I 4,[5],12:i- Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	3	0	8	13	14	35	37	36	33	105	73	83	
	Chicken Breasts						5	2	4	9	9	2	4	
	Ground Turkey						2	0	0	0	2	0	0	
	Ground Beef						0	0	0	0	0	2	0	
	Pork Chops						0	0	0	0	0	0	0	
	Chickens	N/A ¹	N/A	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29
	Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0
	Cattle	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1
	Swine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	1
Resistance Pattern	Isolate Source													
5. At Least ACSSuT² Resistant	Humans	0.0% 0		0.0% 0	0.0% 0	7.1% 1	2.9% 1	0.0% 0	2.8% 1	0.0% 0	1.9% 2	1.4% 1	3.6% 3	
	Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
	Ground Turkey						0.0% 0				0.0% 0			
	Ground Beef											0.0% 0		
	Pork Chops													
	Chickens								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		
	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	100.0% 1	
6. At Least ACT/S³ Resistant	Humans	0.0% 0		0.0% 0	0.0% 0	7.1% 1	2.9% 1	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
	Ground Turkey						0.0% 0				0.0% 0			
	Ground Beef											0.0% 0		
	Pork Chops													
	Chickens								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		
	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	
7. At Least ACSSuTAuCf⁴ 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	0.0% 0	2.4% 2	
	Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
	Ground Turkey						0.0% 0				0.0% 0			
	Ground Beef											0.0% 0		
	Pork Chops													
	Chickens								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		
	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	
8. 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	0.0% 0	0.0% 0	
	Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
	Ground Turkey						0.0% 0				0.0% 0			
	Ground Beef											0.0% 0		
	Pork Chops													
	Chickens								2.3% 1	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		
	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	

¹ N/A = data not available. Antigenic formulas for monophasic *Salmonella* were not determined for food animal isolates prior to 2004

² ACSSuT = ampicillin, chloramphenicol, streptomycin, sulfamethoxazole/sulfisoxazole, and tetracycline

³ ACT/S = ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole

⁴ ACSSuTAuCf = ACSSuT, amoxicillin-clavulanic acid, and ceftiofur

J. Antimicrobial Susceptibility among *Salmonella* Heidelberg

Table 45a. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	75	101	88	79	102	105	96	93	125	102	98	75	
	Chicken Breasts						11	16	31	22	30	14	30	
	Ground Turkey						21	32	37	53	35	41	56	
	Ground Beef						0	0	0	0	0	0	1	
	Pork Chops						3	0	3	0	4	0	0	
	Chickens	51	143	297	259	329	403	226	167	283	164	142	94	
	Turkeys	14	39	139	125	142	60	57	46	25	43	23	8	
	Cattle	1	11	28	6	10	8	9	1	6	4	0	3	
	Swine	7	37	33	22	16	11	11	4	8	13	2	1	
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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Beef												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	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	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	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Gentamicin (MIC ≥ 16)	Humans	17.3% 13	16.8% 17	14.8% 13	8.9% 7	7.8% 8	3.8% 4	5.2% 5	4.3% 4	6.4% 8	4.9% 5	16.3% 16	14.7% 11
		Chicken Breasts						45.5% 5	18.8% 3	9.7% 3	13.6% 3	20.0% 6	7.1% 1	30.0% 9
		Ground Turkey						28.6% 6	12.5% 4	35.1% 13	37.7% 20	31.4% 11	24.4% 10	57.1% 32
		Ground Beef												100.0% 1
		Pork Chops						100.0% 3		0.0% 0		75.0% 3		
		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	9.2% 26	9.8% 16	11.3% 16	10.6% 10
		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	36.0% 9	32.6% 14	13.0% 3	50.0% 4
		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	0.0% 0	0.0% 0		33.3% 1
		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	0.0% 0	0.0% 0	0.0% 0	100.0% 1
	Kanamycin (MIC ≥ 64)	Humans	8.0% 6	12.9% 13	9.1% 8	15.2% 12	19.6% 20	10.5% 11	8.3% 8	8.6% 8	12.8% 16	8.8% 9	11.2% 11	26.7% 20
		Chicken Breasts						36.4% 4	0.0% 0	0.0% 0	0.0% 0	0.0% 0	7.1% 1	13.3% 4
		Ground Turkey						42.9% 9	34.4% 11	27.0% 10	30.2% 16	34.3% 12	56.1% 23	53.6% 30
		Ground Beef												100.0% 1
		Pork Chops						0.0% 0		33.3% 1		0.0% 0		
		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	6.7% 19	7.3% 12	6.3% 9	8.5% 8
		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	44.0% 11	27.9% 12	34.8% 8	50.0% 4
		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	50.0% 3	0.0% 0		33.3% 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	75.0% 6	84.6% 11	100.0% 2	100.0% 1
	Streptomycin (MIC ≥ 64)	Humans	24.0% 18	30.7% 31	23.9% 21	22.8% 18	25.5% 26	17.1% 18	12.5% 12	15.1% 14	13.6% 17	11.8% 12	12.2% 12	30.7% 23
		Chicken Breasts						63.6% 7	12.5% 2	22.6% 7	18.2% 4	23.3% 7	21.4% 3	40.0% 12
		Ground Turkey						61.9% 13	37.5% 12	43.2% 16	47.2% 25	45.7% 16	39.0% 16	71.4% 40
		Ground Beef												100.0% 1
		Pork Chops						100.0% 3		33.3% 1		0.0% 0		
		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	15.5% 44	10.4% 17	13.4% 19	16.0% 15
		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	44.0% 11	34.9% 15	26.1% 6	37.5% 3
		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	50.0% 3	0.0% 0		33.3% 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	87.5% 7	69.2% 9	100.0% 2	100.0% 1

Table 45b. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	75	101	88	79	102	105	96	93	125	102	98	75	
	Chicken Breasts						11	16	31	22	30	14	30	
	Ground Turkey						21	32	37	53	35	41	56	
	Ground Beef						0	0	0	0	0	0	1	
	Pork Chops						3	0	3	0	4	0	0	
	Chickens	51	143	297	259	329	403	226	167	283	164	142	94	
	Turkeys	14	39	139	125	142	60	57	46	25	43	23	8	
	Cattle	1	11	28	6	10	8	9	1	6	4	0	3	
	Swine	7	37	33	22	16	11	11	4	8	13	2	1	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	1.3% 1	1.0% 1	1.1% 1	3.8% 3	2.9% 3	9.5% 10	5.2% 5	10.8% 10	8.8% 11	9.8% 10	7.1% 7	8.0% 6
		Chicken Breasts						0.0% 0	6.3% 1	9.7% 3	13.6% 3	10.0% 3	21.4% 3	16.7% 5
		Ground Turkey						19.0% 4	9.4% 3	5.4% 2	9.4% 5	17.1% 6	9.8% 4	7.1% 4
		Ground Beef												0.0% 0
		Pork Chops						0.0% 0		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	21.9% 62	15.9% 26	17.6% 25	8.5% 8
		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	0.0% 0	9.3% 4	26.1% 6	12.5% 1
		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	83.3% 5	0.0% 0		33.3% 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	0.0% 0	7.7% 1	0.0% 0	0.0% 0
Cephems	Cefoxitin (MIC ≥ 32 µg/ml)	Humans				2.5% 2	2.9% 3	8.6% 9	5.2% 5	8.6% 8	8.8% 11	8.8% 9	7.1% 7	8.0% 6
		Chicken Breasts						0.0% 0	6.3% 1	9.7% 3	9.1% 2	10.0% 3	21.4% 3	16.7% 5
		Ground Turkey						19.0% 4	0.0% 0	5.4% 2	9.4% 5	17.1% 6	9.8% 4	3.6% 2
		Ground Beef												0.0% 0
		Pork Chops						0.0% 0		0.0% 0		0.0% 0		
		Chickens				13.5% 35	5.2% 17	7.4% 30	7.1% 16	10.2% 17	21.6% 61	15.2% 25	16.9% 24	8.5% 8
		Turkeys				2.4% 3	4.9% 7	1.7% 1	0.0% 0	6.5% 3	0.0% 0	9.3% 4	17.4% 4	12.5% 1
		Cattle				0.0% 0	0.0% 0	37.5% 3	44.4% 4	100.0% 1	66.7% 4	0.0% 0		33.3% 1
		Swine				4.5% 1	0.0% 0	9.1% 1	9.1% 1	0.0% 0	0.0% 0	7.7% 1	0.0% 0	0.0% 0
	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	3.8% 3	2.9% 3	7.6% 8	5.2% 5	9.7% 9	8.8% 11	9.8% 10	7.1% 7	8.0% 6
		Chicken Breasts						0.0% 0	6.3% 1	9.7% 3	9.1% 2	10.0% 3	21.4% 3	16.7% 5
		Ground Turkey						19.0% 4	0.0% 0	5.4% 2	9.4% 5	17.1% 6	9.8% 4	3.6% 2
		Ground Beef												0.0% 0
		Pork Chops						0.0% 0		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	21.9% 62	15.9% 26	16.9% 24	8.5% 8
		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	0.0% 0	9.3% 4	26.1% 6	12.5% 1
		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	83.3% 5	0.0% 0		33.3% 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	0.0% 0	7.7% 1	0.0% 0	0.0% 0
	Ceftriaxone (MIC ≥ 4 µg/ml) ¹	Humans	0.0% 0	0.0% 0	0.0% 0	3.8% 3	2.9% 3	7.6% 8	5.2% 5	9.7% 9	8.8% 11	9.8% 10	7.1% 7	8.0% 6
		Chicken Breasts						0.0% 0	6.3% 1	9.7% 3	9.1% 2	10.0% 3	21.4% 3	16.7% 5
		Ground Turkey						19.1% 4	0.0% 0	5.4% 2	9.4% 5	17.1% 6	9.8% 4	3.6% 2
		Ground Beef												0.0% 0
		Pork Chops						0.0% 0		0.0% 0		0.0% 0		
		Chickens	0.0% 0	0.7% 1	1.3% 4	13.5% 35	5.8% 19	8.9% 36	9.3% 21	10.2% 17	21.9% 62	15.9% 26	17.6% 25	8.5% 8
		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	0.0% 0	9.3% 4	26.1% 6	12.5% 1
		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	83.3% 5	0.0% 0		33.3% 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	0.0% 0	7.7% 1	0.0% 0	0.0% 0

¹Breakpoints for ceftriaxone were revised to reflect those published in CLSI document M100-S20

Table 45c. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008		
Number of Isolates Tested	Humans	75	101	88	79	102	105	96	93	125	102	98	75		
	Chicken Breasts						11	16	31	22	30	14	30		
	Ground Turkey						21	32	37	53	35	41	56		
	Ground Beef						0	0	0	0	0	0	1		
	Pork Chops						3	0	3	0	4	0	0		
	Chickens	51	143	297	259	329	403	226	167	283	164	142	94		
	Turkeys	14	39	139	125	142	60	57	46	25	43	23	8		
	Cattle	1	11	28	6	10	8	9	1	6	4	0	3		
	Swine	7	37	33	22	16	11	11	4	8	13	2	1		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source													
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole ¹ (MIC ≥ 512 µg/ml)	Humans	21.3% 16	21.8% 22	18.2% 16	11.4% 9	8.8% 9	6.7% 7	7.3% 7	7.5% 7	8.0% 10	4.9% 5	18.4% 18	12.0% 9	
		Chicken Breasts						45.5% 5	12.5% 2	12.9% 4	13.6% 3	26.7% 8	7.1% 1	30.0% 9	
		Ground Turkey						33.3% 7	15.6% 5	37.8% 14	35.8% 19	37.1% 13	26.8% 11	28.6% 16	
		Ground Beef												100.0% 1	
		Pork Chops						100.0% 3		0.0% 0		100.0% 4			
		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	10.6% 30	7.9% 13	13.4% 19	12.8% 12	
		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	52.0% 13	30.2% 13	34.8% 8	37.5% 3	
		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	50.0% 3	0.0% 0		33.3% 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	12.5% 1	0.0% 0	0.0% 0	100.0% 1	
	Trimethoprim- Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	0.0% 0	2.0% 2	1.1% 1	1.3% 1	2.0% 2	1.0% 1	2.1% 2	0.0% 0	0.8% 1	0.0% 0	0.0% 0	2.7% 2	
		Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	6.7% 2	0.0% 0	0.0% 0	
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
		Ground Beef												0.0% 0	
		Pork Chops						0.0% 0		0.0% 0		100.0% 4			
		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	0.4% 1	0.0% 0	0.0% 0	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	0.0% 0	0.0% 0	4.3% 1	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	50.0% 3	0.0% 0		0.0% 0	
		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	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
	Penicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	13.3% 10	16.8% 17	6.8% 6	10.1% 8	9.8% 10	12.4% 13	10.4% 10	25.8% 24	20.0% 25	18.6% 19	18.4% 18	28.0% 21
			Chicken Breasts						18.2% 2	18.8% 3	25.8% 8	27.3% 6	16.7% 5	21.4% 3	23.3% 7
			Ground Turkey						19.0% 4	9.4% 3	13.5% 5	18.9% 10	31.4% 11	53.7% 22	83.9% 47
			Ground Beef												0.0% 0
			Pork Chops						0.0% 0		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	25.1% 71	16.5% 27	20.4% 29	13.8% 13
			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	24.0% 6	37.2% 16	65.2% 15	50.0% 4
			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	83.3% 5	0.0% 0		66.7% 2
			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	12.5% 1	7.7% 1	0.0% 0	100.0% 1
	Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	0.0% 0	1.0% 1	1.1% 1	1.3% 1	1.0% 1	1.0% 1	0.0% 0	1.1% 1	0.8% 1	0.0% 0	3.1% 3	1.3% 1
Chicken Breasts								0.0% 0	0.0% 0	3.2% 1	0.0% 0	0.0% 0	7.1% 1	3.3% 1	
Ground Turkey								0.0% 0	0.0% 0	5.4% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
Ground Beef														0.0% 0	
Pork Chops								0.0% 0		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	3.2% 9	2.4% 4	4.2% 6	4.3% 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	0.0% 0	4.7% 2	4.3% 1	12.5% 1	
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	50.0% 3	0.0% 0		0.0% 0	
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	0.0% 0	0.0% 0	0.0% 0	100.0% 1	

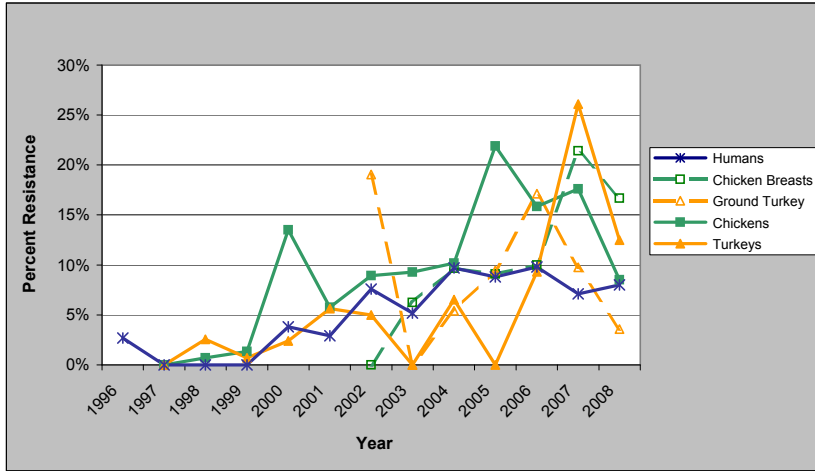
¹ Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

Table 45d. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	75	101	88	79	102	105	96	93	125	102	98	75	
	Chicken Breasts						11	16	31	22	30	14	30	
	Ground Turkey						21	32	37	53	35	41	56	
	Ground Beef						0	0	0	0	0	0	1	
	Pork Chops						3	0	3	0	4	0	0	
	Chickens	51	143	297	259	329	403	226	167	283	164	142	94	
	Turkeys	14	39	139	125	142	60	57	46	25	43	23	8	
	Cattle	1	11	28	6	10	8	9	1	6	4	0	3	
	Swine	7	37	33	22	16	11	11	4	8	13	2	1	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
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%	
		Chicken Breasts						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
		Ground Turkey						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
		Ground Beef											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%	0.0%	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%
		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%	1.0%	1.1%	1.3%	0.0%	0.0%	1.0%	0.0%	0.8%	0.0%	0.0%	0.0%
		Chicken Breasts						0.0%	0.0%	0.0%	0.0%	3.3%	0.0%	0.0%
		Ground Turkey						4.8%	0.0%	0.0%	1.9%	0.0%	0.0%	0.0%
		Ground Beef												0.0%
		Pork Chops						0.0%		0.0%		0.0%		
		Chickens	0.0%	0.0%	0.3%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Turkeys	0.0%	0.0%	0.7%	0.8%	0.0%	1.7%	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%
		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	12.0%	19.8%	18.2%	21.5%	24.5%	19.0%	16.7%	19.4%	18.4%	13.7%	22.4%	36.0%
		Chicken Breasts						45.5%	0.0%	6.5%	4.5%	3.3%	7.1%	26.7%
		Ground Turkey						57.1%	43.8%	70.3%	56.6%	68.6%	70.7%	80.4%
		Ground Beef												100.0%
		Pork Chops						66.7%		100.0%		0.0%		
		Chickens	2.0%	7.7%	7.7%	20.1%	14.9%	11.7%	16.4%	15.0%	14.5%	12.2%	12.7%	13.8%
		Turkeys	14.3%	23.1%	38.1%	64.0%	54.2%	70.0%	84.2%	73.9%	64.0%	62.8%	65.2%	87.5%
		Cattle	0.0%	63.6%	60.7%	33.3%	40.0%	62.5%	55.6%	100.0%	66.7%	0.0%		33.3%
		Swine	85.7%	73.0%	72.7%	81.8%	93.8%	72.7%	100.0%	75.0%	87.5%	92.3%	100.0%	100.0%

Ceftriaxone Resistance

Figure 17. Percent of *Salmonella* Heidelberg Isolates from Humans, Retail Poultry, and Poultry Resistant to Ceftriaxone, by Year, 1996-2008¹



¹ Data for ground beef, pork chops, cattle, and swine are not included due to the small number of *Salmonella* Heidelberg isolates from these sources. Table 45 contains resistance data for *Salmonella* Heidelberg isolates from each source, by year

Table 46. Number of *Salmonella* Heidelberg Isolates Tested from Humans, Food Animals, and Retail Meats, by Year, 1996-2008

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	74	75	101	88	79	102	105	96	93	125	102	98	75
Chicken Breasts							11	16	31	22	30	14	30
Ground Turkey							21	32	37	53	35	41	56
Ground Beef							0	0	0	0	0	0	1
Pork Chops							3	0	3	0	4	0	0
Chickens		51	143	297	259	329	403	226	167	283	164	142	94
Turkeys		14	39	139	125	142	60	57	46	25	43	23	8
Cattle		1	11	28	6	10	8	9	1	6	4	0	3
Swine		7	37	33	22	16	11	11	4	8	13	2	1

Multidrug Resistance

Table 47a. Resistance Patterns among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	75	101	88	79	102	105	96	93	125	102	98	75
	Chicken Breasts						11	16	31	22	30	14	30
	Ground Turkey						21	32	37	53	35	41	56
	Ground Beef						0	0	0	0	0	0	1
	Pork Chops						3	0	3	0	4	0	0
	Chickens	51	143	297	259	329	403	226	167	283	164	142	94
	Turkeys	14	39	139	125	142	60	57	46	25	43	23	8
	Cattle	1	11	28	6	10	8	9	1	6	4	0	3
	Swine	7	37	33	22	16	11	11	4	8	13	2	1
Resistance Pattern	Isolate Source												
1. No Resistance Detected	Humans	66.7% 50	56.4% 57	68.2% 60	63.3% 50	64.7% 66	67.6% 71	68.8% 66	55.9% 52	62.4% 78	67.6% 69	58.2% 57	57.3% 43
	Chicken Breasts						27.3% 3	62.5% 10	58.1% 18	54.5% 12	50.0% 15	50.0% 7	50.0% 15
	Ground Turkey						33.3% 7	50.0% 16	16.2% 6	20.8% 11	8.6% 3	9.8% 4	1.8% 1
	Ground Beef												0.0% 0
	Pork Chops						0.0% 0		0.0% 0		0.0% 0		
	Chickens	35.3% 18	50.3% 72	61.6% 183	48.6% 126	63.5% 209	66.5% 268	62.8% 142	68.3% 114	59.4% 168	67.1% 110	65.5% 93	70.2% 66
	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	16.0% 4	23.3% 10	17.4% 4	0.0% 0
	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	0.0% 0	100.0% 4		33.3% 1
	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	12.5% 1	7.7% 1	0.0% 0	0.0% 0
2. Resistant to ≥ 3 Antimicrobial Classes	Humans	12.0% 9	13.9% 14	10.2% 9	7.6% 6	7.8% 8	12.4% 13	10.4% 10	14.0% 13	15.2% 19	12.7% 13	17.3% 17	28.0% 21
	Chicken Breasts						45.5% 5	6.3% 1	12.9% 4	13.6% 3	13.3% 4	28.6% 4	36.7% 11
	Ground Turkey						28.6% 6	12.5% 4	27.0% 10	34.0% 18	40.0% 14	53.7% 22	83.9% 47
	Ground Beef												100.0% 1
	Pork Chops						66.7% 2		0.0% 0		0.0% 0		
	Chickens	11.8% 6	15.4% 22	10.4% 31	19.3% 50	12.8% 42	10.9% 44	13.3% 30	15.6% 26	24.4% 69	17.1% 28	20.4% 29	12.8% 12
	Turkeys	7.1% 1	10.3% 4	17.3% 24	10.4% 13	16.9% 24	21.7% 13	14.0% 8	23.9% 11	36.0% 9	44.2% 19	69.6% 16	50.0% 4
	Cattle	0.0% 0	27.3% 3	50.0% 14	0.0% 0	10.0% 1	37.5% 3	55.6% 5	100.0% 1	83.3% 5	0.0% 0		66.7% 2
	Swine	0.0% 0	13.5% 5	21.2% 7	13.6% 3	0.0% 0	18.2% 2	9.1% 1	0.0% 0	25.0% 2	7.7% 1	0.0% 0	100.0% 1
3. Resistant to ≥ 4 Antimicrobial Classes	Humans	1.3% 1	3.0% 3	3.4% 3	3.8% 3	2.0% 2	1.9% 2	0.0% 0	4.3% 4	4.8% 6	2.0% 2	5.1% 5	13.3% 10
	Chicken Breasts						9.1% 1	0.0% 0	6.5% 2	0.0% 0	0.0% 0	0.0% 0	13.3% 4
	Ground Turkey						19.1% 4	9.4% 3	10.8% 4	7.6% 4	17.1% 6	14.6% 6	19.6% 11
	Ground Beef												0.0% 0
	Pork Chops						0.0% 0		0.0% 0		0.0% 0		
	Chickens	2.0% 1	1.4% 2	3.7% 11	13.5% 35	4.0% 13	3.7% 15	5.3% 12	7.8% 13	6.7% 19	4.3% 7	6.3% 9	4.2% 4
	Turkeys	0.0% 0	2.6% 1	2.2% 3	4.0% 5	5.6% 8	6.7% 4	1.8% 1	6.5% 3	12.0% 3	14.0% 6	21.7% 5	25.0% 2
	Cattle	0.0% 0	27.3% 3	42.9% 12	0.0% 0	10.0% 1	25.0% 2	55.6% 5	100.0% 1	50.0% 3	0.0% 0		33.0% 1
	Swine	0.0% 0	5.4% 2	3.0% 1	4.5% 1	0.0% 0	9.1% 1	9.1% 1	0.0% 0	0.0% 0	7.7% 1	0.0% 0	100.0% 1
4. Resistant to ≥ 5 Antimicrobial Classes	Humans	1.3% 1	0.0% 0	0.0% 0	2.5% 2	1.0% 1	1.9% 2	0.0% 0	3.2% 3	1.6% 2	2.0% 2	4.1% 4	6.7% 5
	Chicken Breasts						0.0% 0	0.0% 0	3.2% 1	0.0% 0	0.0% 0	0.0% 0	6.7% 2
	Ground Turkey						19.1% 4	9.4% 3	5.4% 2	0.0% 0	8.6% 3	2.4% 1	1.8% 1
	Ground Beef												0.0% 0
	Pork Chops						0.0% 0		0.0% 0		0.0% 0		
	Chickens	0.0% 0	0.7% 1	1.3% 4	12.4% 32	3.6% 12	2.7% 11	4.4% 10	3.6% 6	4.9% 14	4.3% 7	5.6% 8	4.2% 4
	Turkeys	0.0% 0	2.6% 1	0.7% 1	3.2% 4	4.2% 6	3.3% 2	0.0% 0	2.2% 1	0.0% 0	9.3% 4	8.7% 2	25.0% 2
	Cattle	0.0% 0	27.3% 3	42.9% 12	0.0% 0	0.0% 0	25.0% 2	55.6% 5	100.0% 1	50.0% 3	0.0% 0		0.0% 0
	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	0.0% 0	7.7% 1	0.0% 0	100.0% 1

Table 47b. Resistance Patterns among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	75	101	88	79	102	105	96	93	125	102	98	75
	Chicken Breasts						11	16	31	22	30	14	30
	Ground Turkey						21	32	37	53	35	41	56
	Ground Beef						0	0	0	0	0	0	1
	Pork Chops						3	0	3	0	4	0	0
	Chickens	51	143	297	259	329	403	226	167	283	164	142	94
	Turkeys	14	39	139	125	142	60	57	46	25	43	23	8
	Cattle	1	11	28	6	10	8	9	1	6	4	0	3
Swine	7	37	33	22	16	11	11	4	8	13	2	1	
Resistance Pattern	Isolate Source												
5. At Least ACSSuT¹ Resistant	Humans	0.0% 0	0.0% 0	0.0% 0	1.3% 1	1.0% 1	1.0% 1	0.0% 0	1.1% 1	0.0% 0	0.0% 0	3.1% 3	1.3% 1
	Chicken Breasts						0.0% 0	0.0% 0	3.2% 1	0.0% 0	0.0% 0	0.0% 0	3.3% 1
	Ground Turkey						0.0% 0	0.0% 0	5.4% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Beef												0.0% 0
	Pork Chops						0.0% 0		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	2.8% 8	1.8% 3	4.2% 6	4.2% 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	0.0% 0	4.7% 2	4.3% 1	12.5% 1
	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	50.0% 3	0.0% 0		0.0% 0
	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	0.0% 0	0.0% 0	0.0% 0	100.0% 1
6. At Least ACT/S² Resistant	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.0% 1	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Beef												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	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	0.0% 0	0.0% 0	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	50.0% 3	0.0% 0		0.0% 0
	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
7. At Least ACSSuTAuCf³ Resistant	Humans	0.0% 0	0.0% 0	0.0% 0	1.3% 1	1.0% 1	1.0% 1	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	3.2% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Turkey						0.0% 0	0.0% 0	5.4% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Beef												0.0% 0
	Pork Chops						0.0% 0		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	2.8% 8	1.8% 3	4.2% 6	2.1% 2
	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	0.0% 0	4.7% 2	4.3% 1	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	50.0% 3	0.0% 0		0.0% 0
	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
8. 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	0.0% 0	0.0% 0	0.0% 0
	Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Beef												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	0.7% 3	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	1.7% 1	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	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	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

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

IV. *Campylobacter* Data

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

Table 48. Number of *Campylobacter jejuni* Isolates Tested, by Source and Year, 1997-2008¹

Source	Year											
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	209	297	293	306	365	329	303	320	791	709	992	1055
Chicken Breasts						198	325	510	403	426	332	329
Ground Turkey						2	4	7	10	12	20	10
Chickens					64 ²	526	374	508	567	228	166	78

¹ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

² These isolates were recovered from July through December, 2001, when the new ARS isolation method was used

Table 49. Number of *Campylobacter coli* Isolates Tested, by Source and Year, 1997-2008¹

Source	Year											
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	6	8	20	12	17	25	22	26	98	97	105	101
Chicken Breasts						90	142	196	151	145	143	181
Ground Turkey						2	1	5	9	10	14	19
Chickens					52 ²	288	247	186	380	123	76	28

¹ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

² 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 50. Number and Percent of Retail Meat Samples Culture Positive for *Campylobacter*, 2008¹

	Chicken Breasts	Ground Turkey
Number of Meat Samples Tested	1190	1189
Number Positive for <i>Campylobacter</i>	510	31
Percent Positive for <i>Campylobacter</i>	42.9%	2.6%

¹ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

Figure 18. Percent of Retail Meat Samples Culture Positive for *Campylobacter*, 2008

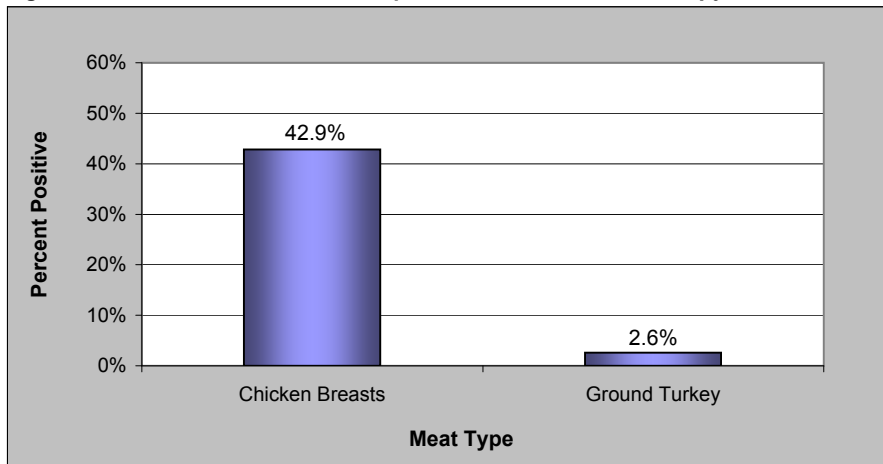
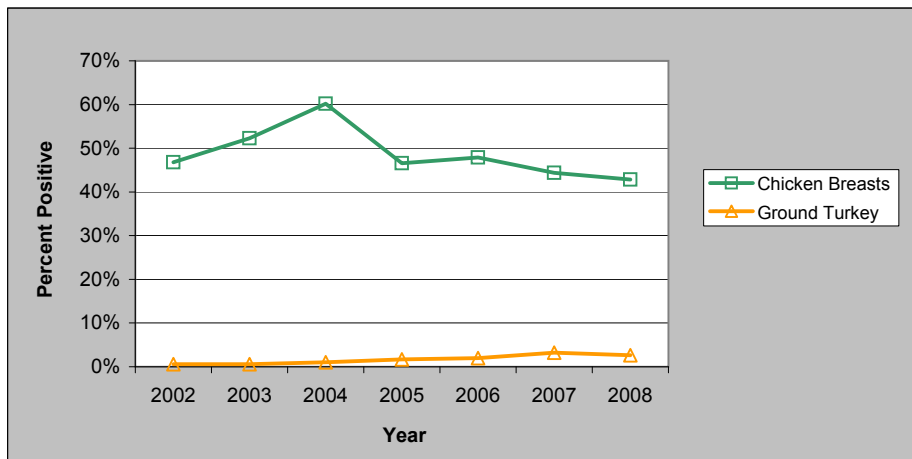


Figure 19. Percent of Retail Meat Samples Culture Positive for *Campylobacter*, 2002-2008



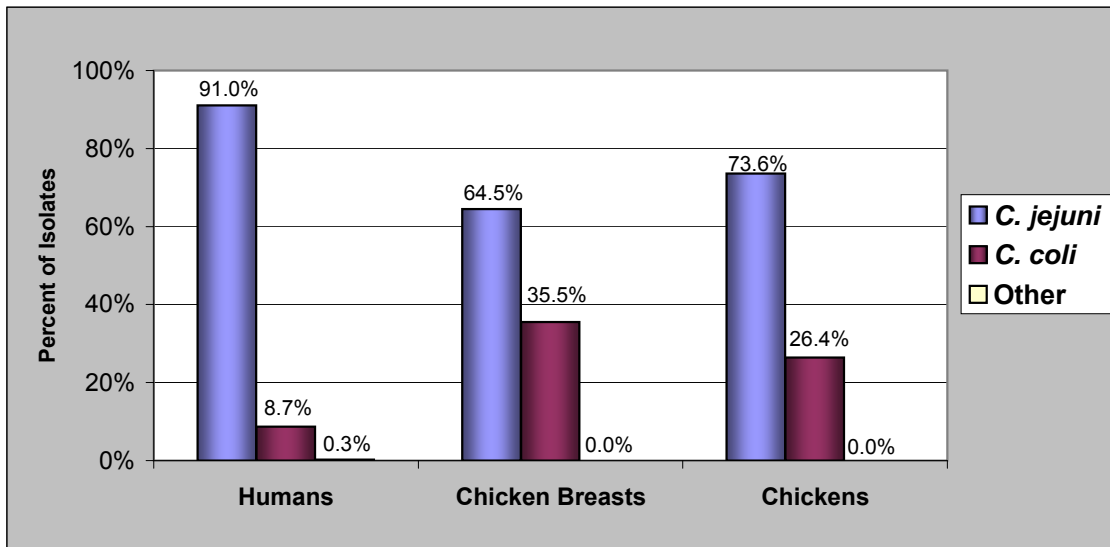
C. Campylobacter Species

Table 51. *Campylobacter* Species Isolated from Humans, Retail Meats, and Chickens, 2008

	Humans	Retail Meats ¹		Food Animals
<i>Campylobacter</i> Species	Humans (N=1159)	Chicken Breasts (N=510)	Ground Turkey (N=31)	Chickens (N=106)
<i>C. jejuni</i>	91.0% 1055	64.5% 329	32.3% 10	73.6% 78
<i>C. coli</i>	8.7% 101	35.5% 181	61.3% 19	26.4% 28
Other	0.3% 3	0.0% 0	6.5% 2	0.0% 0

¹ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

Figure 20. *Campylobacter* Species Isolated from Humans, Chicken Breasts, and Chickens, 2008



D. Antimicrobial Susceptibility among *Campylobacter jejuni*

MIC Distributions

Table 52a. Distribution of MICs and Occurrence of Resistance among *Campylobacter jejuni* Isolates from Humans, Retail Meats, and Chickens, 2008

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
Aminoglycosides																		
Gentamicin	Humans (1055)	0.0	1.1	[0.6 - 2.0]				3.2	37.3	53.6	4.6	<0.1						1.1
	Chicken Breasts (329)	0.0	0.0	[0.0 - 1.1]					3.7	88.2	8.2							
	Ground Turkey (10)	0.0	0.0	[0.0 - 30.8]						40.0	60.0							
	Chickens (78)	0.0	1.3	[0.0 - 6.9]				12.8	39.7	43.6	2.6							1.3
Ketolides																		
Telithromycin	Humans (1055)	0.2	2.2	[1.4 - 3.3]				0.6	7.2	28.9	39.4	19.6	1.9	0.2	2.2			
	Chicken Breasts (329)	0.9	0.3	[0.0 - 1.7]				1.2	10.6	42.9	30.4	13.7		0.9	0.3			
	Ground Turkey (10)	0.0	10.0	[0.3 - 44.5]					10.0	20.0	40.0	20.0			10.0			
	Chickens (78)	0.0	0.0	[0.0 - 4.6]					24.4	52.6	19.2	2.6	1.3					
Lincosamides																		
Clindamycin	Humans (1055)	0.3	2.1	[1.3 - 3.1]		1.6	17.7	46.8	24.4	5.6	1.3	0.2	0.3	0.7	0.6	0.9		
	Chicken Breasts (329)	0.3	0.9	[0.2 - 2.6]		3.7	20.4	45.3	27.4	1.5	0.6		0.3	0.6	0.3			
	Ground Turkey (10)	0.0	10.0	[0.3 - 44.5]				50.0	40.0					10.0				
	Chickens (78)	0.0	0.0	[0.0 - 4.6]		2.6	43.6	44.9	7.7			1.3						
Macrolides																		
Azithromycin	Humans (1055)	0.0	2.3	[1.5 - 3.4]	0.9	18.8	46.2	25.9	5.7	<0.1	<0.1	0.2						2.3
	Chicken Breasts (329)	0.0	1.2	[0.3 - 3.1]	3.7	32.2	45.6	15.8	1.5									1.2
	Ground Turkey (10)	0.0	10.0	[0.3 - 44.5]		20.0	30.0	30.0	10.0									10.0
	Chickens (78)	0.0	1.3	[0.0 - 6.9]	11.5	60.3	26.9											1.3
Erythromycin	Humans (1055)	0.0	2.3	[1.5 - 3.4]			0.2	2.3	24.3	42.4	23.0	5.0	0.6					2.3
	Chicken Breasts (329)	0.0	1.2	[0.3 - 3.1]			0.6	6.1	35.9	38.6	14.9	2.7						1.2
	Ground Turkey (10)	0.0	10.0	[0.3 - 44.5]					30.0	30.0	20.0	10.0						10.0
	Chickens (78)	0.0	1.3	[0.0 - 6.9]				14.1	48.7	34.6	1.3							1.3

¹ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

² Percent of isolates with intermediate susceptibility

³ Percent resistant; for florfenicol, percent non-susceptible

⁴ 95% confidence intervals for percent resistant (%R) were 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 areas 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

Table 52b. Distribution of MICs and Occurrence of Resistance among *Campylobacter jejuni* Isolates from Humans, Retail Meats, and Chickens, 2008

Antimicrobial	Isolate Source				Distribution (%) of MICs (µg/ml) ⁵															
	(# of Isolates) ¹	% ²	%R ³	[95% CI] ⁴	0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	
Phenicol Florfenicol ⁶	Humans (1055)	N/A	0.6	[0.2 - 1.2]																
	Chicken Breasts (329)	N/A	0.0	[0.0 - 1.1]																
	Ground Turkey (10)	N/A	0.0	[0.0 - 30.8]																
	Chickens (78)	N/A	0.0	[0.0 - 4.6]																
Quinolones Ciprofloxacin	Humans (1055)	<0.1	22.4	[19.9 - 25.0]	2.7	36.3	31.8	6.0	0.8	<0.1	<0.1	0.8	9.3	6.9	3.6	1.0				
	Chicken Breasts (329)	0.0	14.6	[11.0 - 18.9]	0.3	26.4	46.8	11.6	0.3				4.0	7.9	2.7					
	Ground Turkey (10)	0.0	60.0	[26.2 - 87.8]				20.0	10.0				10.0	30.0	30.0					
	Chickens (78)	0.0	32.1	[21.9 - 43.6]				1.3	47.4	17.9	1.3	2.6	23.1	6.4						
Nalidixic acid	Humans (1055)	<0.1	22.8	[20.3 - 25.5]								65.5	10.1	1.4	<0.1	2.9				
	Chicken Breasts (329)	0.0	14.6	[11.0 - 18.9]								69.3	15.8	0.3	0.9					
	Ground Turkey (10)	0.0	60.0	[26.2 - 87.8]								30.0	10.0	60.0						
	Chickens (78)	0.0	33.3	[23.1 - 44.9]								66.7	11.5	21.8						
Tetracyclines Tetracycline	Humans (1055)	0.5	44.3	[41.2 - 47.3]					4.8	25.9	15.8	5.4	2.8	0.4	<0.1	0.5	0.8	2.7	10.9	29.9
	Chicken Breasts (329)	0.0	49.8	[44.3 - 55.4]					0.6	16.1	19.5	9.7	3.7	0.6	0.6	4.6	20.4	24.3		
	Ground Turkey (10)	0.0	100.0	[69.2 - 100.0]								10.0	10.0	10.0	20.0	70.0				
	Chickens (78)	1.3	53.8	[42.2 - 65.2]								20.5	17.9	6.4	1.3	2.6	10.3	19.2	21.8	

¹ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

² Percent of isolates with intermediate susceptibility

³ Percent resistant; for florfenicol, percent non-susceptible

⁴ 95% confidence intervals for percent resistant (%R) were 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 areas 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

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 53a. Antimicrobial Resistance among *Campylobacter jejuni* Isolates from Humans, Retail Meats, and Chickens, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	209	297	293	306	365	329	303	320	791	709	992	1055	
	Chicken Breasts						198	325	510	403	426	332	329	
	Ground Turkey						2	4	7	10	12	20	10	
	Chickens					64 ¹	526	374	508	567	228	166	78	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)²	Isolate Source³												
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	0.5% 4	0.0% 0	0.7% 7	1.1% 12
		Chicken Breasts						0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey						0.0% 0	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	0.2% 1	0.0% 0	0.0% 0	0.0% 0	1.3% 1
Ketolides	Telithromycin (MIC ≥ 16 µg/ml)	Humans								0.6% 5	0.8% 6	1.0% 10	2.2% 23	
		Chicken Breasts							0.4% 2	0.5% 2	0.7% 3	0.6% 2	0.3% 1	
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0	5.0% 1	10.0% 1	
		Chickens								0.4% 2	0.0% 0	0.0% 0	0.0% 0	
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	1.1% 9	1.0% 7	1.3% 13	2.1% 22
		Chicken Breasts							0.4% 2	0.5% 2	0.7% 3	0.6% 2	0.9% 3	
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0	5.0% 1	10.0% 1	
		Chickens					0.0% 0	0.4% 2	0.8% 3	0.2% 1	0.4% 2	0.0% 0	0.0% 0	0.0% 0
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	1.8% 14	0.8% 6	1.6% 16	2.3% 24
		Chicken Breasts								0.8% 4	0.5% 2	0.9% 4	0.6% 2	1.2% 4
		Ground Turkey								0.0% 0	0.0% 0	0.0% 0	5.0% 1	10.0% 1
		Chickens					3.1% 2	0.6% 3	1.3% 5	1.6% 8	1.4% 8	0.4% 1	0.0% 0	1.3% 1
	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	1.6% 13	0.8% 6	1.6% 16	2.3% 24
		Chicken Breasts						0.0% 0	0.0% 0	0.8% 4	0.5% 2	0.9% 4	0.6% 2	1.2% 4
		Ground Turkey						0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	5.0% 1	10.0% 1
		Chickens					3.1% 2	0.6% 3	1.6% 6	1.2% 6	1.1% 6	0.4% 1	0.0% 0	1.3% 1
Phenicol	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				
	Florfenicol (MIC ≥ 8) ⁴	Humans									0.5% 4	0.0% 0	0.0% 0	0.6% 6
		Chicken Breasts								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey								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	

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

² Resistance figures for gentamicin, clindamycin, azithromycin, erythromycin, nalidixic acid, and doxycycline in this report may differ from previously published figures because breakpoints have been revised for these antimicrobials

³ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

⁴ 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

Table 53b. Antimicrobial Resistance among *Campylobacter jejuni* Isolates from Humans, Retail Meats, and Chickens, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	209	297	293	306	365	329	303	320	791	709	992	1055	
	Chicken Breasts						198	325	510	403	426	332	329	
	Ground Turkey						2	4	7	10	12	20	10	
	Chickens					64 ¹	526	374	508	567	228	166	78	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)²	Isolate Source³												
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	21.5% 170	19.5% 138	25.8% 256	22.4% 236
		Chicken Breasts						15.2% 30	14.5% 47	15.1% 77	15.1% 61	16.7% 71	17.2% 57	14.6% 48
		Ground Turkey						50.0% 1	0.0% 0	28.6% 2	10.0% 1	50.0% 6	30.0% 6	60.0% 6
		Chickens					20.3% 13	18.6% 98	14.7% 55	21.3% 108	15.0% 85	8.8% 20	21.7% 36	32.1% 25
	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	21.9% 173	19.0% 135	26.1% 259	22.8% 241
		Chicken Breasts								15.1% 77	14.9% 60	16.7% 71	17.2% 57	14.6% 48
		Ground Turkey								28.6% 2	10.0% 1	50.0% 6	30.0% 6	60.0% 6
		Chickens					20.3% 13	22.1% 116	15.5% 58	21.7% 110	15.3% 87	8.8% 20	21.7% 36	33.3% 26
Tetracyclines	Doxycycline (MIC ≥ 8 µg/ml)	Chicken Breasts						38.4% 76	40.6% 132					
		Ground Turkey						100.0% 2	75.0% 3					
	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	41.8% 331	47.4% 336	44.8% 444	44.3% 467
		Chicken Breasts								50.2% 256	46.4% 187	47.2% 201	48.5% 161	49.9% 164
		Ground Turkey								42.9% 3	70.0% 7	75.0% 9	90.0% 18	100.0% 10
		Chickens					35.9% 23	45.1% 237	47.6% 178	42.3% 215	44.1% 250	56.1% 128	56.6% 94	53.8% 42

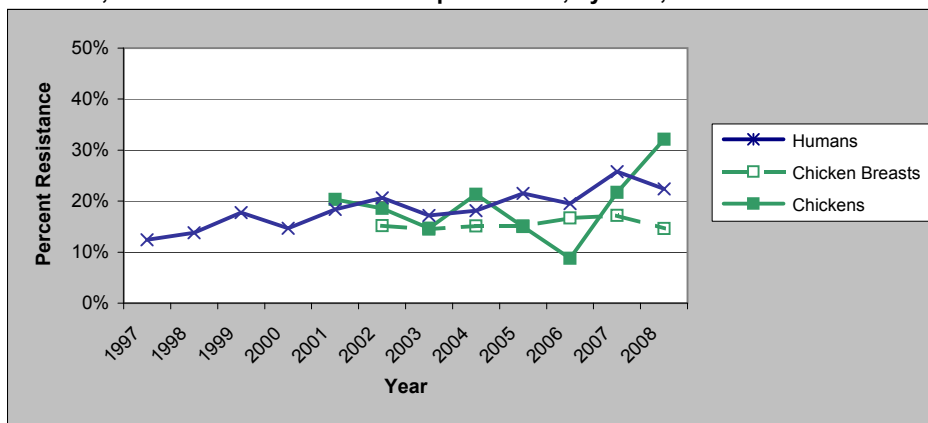
¹ These isolates were recovered from July through December, 2001, when the new ARS isolation method was used

² Resistance figures for gentamicin, clindamycin, azithromycin, erythromycin, nalidixic acid, and doxycycline in this report may differ from previously published figures because breakpoints have been revised for these antimicrobials

³ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

Ciprofloxacin Resistance

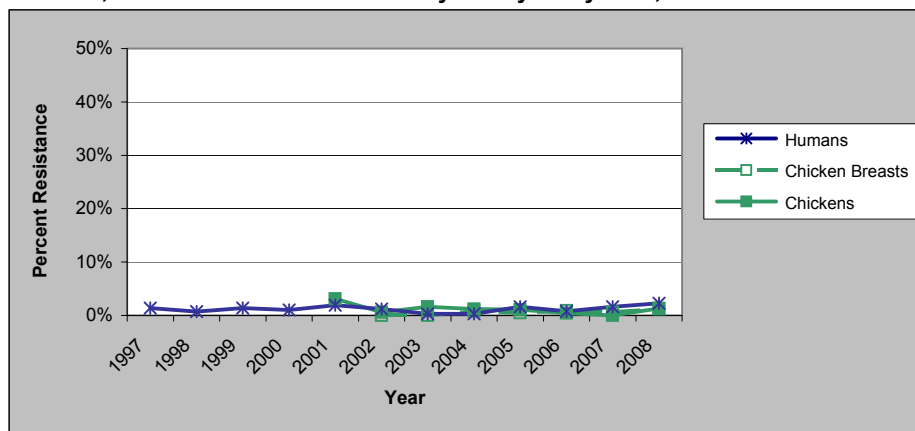
Figure 21. Percent of *Campylobacter jejuni* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Ciprofloxacin, by Year, 1997-2008¹



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 53 contains resistance data for *C. jejuni* isolates from each source, by year

Erythromycin Resistance

Figure 22. Percent of *Campylobacter jejuni* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Erythromycin by Year, 1997-2008¹



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 53 contains resistance data for *C. jejuni* isolates from each source, by year

Table 54. Number of *Campylobacter jejuni* Isolates Tested from Humans, Retail Meats², and Chickens by Year, 1997-2008

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	209	297	293	306	365	329	303	320	791	709	992	1055
Chicken Breasts						198	325	510	403	426	332	329
Ground Turkey						2	4	7	10	12	20	10
Chickens					64 ¹	526	374	508	567	228	166	78

¹ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports.

² These isolates were recovered from July through December 2001, when the new ARS isolation method was used

Table 55. Resistance Patterns among *Campylobacter jejuni* Isolates from Humans, Retail Meats and Food Animals, by Year, 2004-2008¹

Year		2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	N/A ¹	791	709	992	1055
	Chicken Breasts	510	403	426	332	329
	Ground Turkey	7	10	12	20	10
	Chickens	N/A ¹	567	228	166	78
Resistance Patterns	Isolate Source ²					
1. No Resistance Detected	Humans		48.0% 380	43.7% 310	45.5% 451	45.7% 482
	Chicken Breasts	41.0% 209	43.4% 175	43.9% 187	40.4% 134	40.4% 133
	Ground Turkey	42.9% 3	30.0% 3	16.7% 2	10.0% 2	0.0% 0
	Chickens		46.9% 266	39.9% 91	34.3% 57	33.3% 26
2. Resistance to ≥ 2 Antimicrobial Classes	Humans		13.8% 109	11.4% 81	17.4% 173	14.8% 156
	Chicken Breasts	7.1% 36	6.0% 24	8.7% 37	7.2% 24	7.0% 23
	Ground Turkey	14.3% 1	10.0% 1	41.7% 5	30.0% 6	70.0% 7
	Chickens		8.3% 47	5.3% 12	12.7% 21	23.1% 18
3. Resistance to ≥ 3 Antimicrobial Classes	Humans		1.3% 10	0.7% 5	1.3% 13	2.2% 23
	Chicken Breasts	0.4% 2	0.5% 2	0.7% 3	0.6% 2	0.3% 1
	Ground Turkey	0.0% 0	0.0% 0	0.0% 0	5.0% 1	10.0% 1
	Chickens		0.5% 3	0.0% 0	0.0% 0	0.0% 0
4. Resistance to ≥ 4 Antimicrobial Classes	Humans		0.3% 2	0.3% 2	0.9% 9	1.0% 11
	Chicken Breasts	0.4% 2	0.3% 1	0.7% 3	0.0% 0	0.0% 0
	Ground Turkey	0.0% 0	0.0% 0	0.0% 0	5.0% 1	10.0% 1
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0
4. At Least Quinolone and Macrolide Resistant	Humans		1.0% 8	0.6% 4	1.3% 13	1.5% 16
	Chicken Breasts	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ground Turkey	0.0% 0	0.0% 0	0.0% 0	5.0% 1	0.0% 0
	Chickens		0.2% 1	0.4% 1	0.0% 0	1.3% 1
5. At Least Quinolone and Tetracycline Resistant	Humans		12.4% 98	10.7% 76	17.0% 169	13.7% 145
	Chicken Breasts	6.3% 32	5.5% 22	8.0% 34	6.6% 22	6.1% 20
	Ground Turkey	14.3% 1	10.0% 1	41.7% 5	30.0% 6	60.0% 6
	Chickens		7.2% 41	4.8% 11	12.7% 21	20.5% 16

¹ Data are reported for retail meats beginning in 2004 and for humans and chickens beginning in 2005 when the broth microdilution method was first used

² Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

E. Antimicrobial Susceptibility among *Campylobacter coli*

MIC Distributions

Table 56a. Distribution of MICs and Occurrence of Resistance among *Campylobacter coli* Isolates from Humans, Retail Meats, and Chickens, 2008

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
Aminoglycosides																		
Gentamicin	Humans (101)	0.0	1.0	[0.0 - 5.4]														
	Chicken Breasts (181)	0.0	1.7	[0.3 - 4.8]														
	Ground Turkey (19)	0.0	0.0	[0.0 - 17.6]														
	Chickens (28)	0.0	3.6	[0.1 - 18.3]														
Ketolides																		
Telithromycin	Humans (101)	5.0	5.9	[2.2 - 12.5]														
	Chicken Breasts (181)	1.7	7.7	[4.3 - 12.6]														
	Ground Turkey (19)	0.0	5.3	[0.1 - 26.0]														
	Chickens (28)	0.0	3.6	[0.1 - 18.3]														
Lincosamides																		
Clindamycin	Humans (101)	3.0	9.9	[4.9 - 17.5]														
	Chicken Breasts (181)	2.8	5.0	[2.3 - 9.2]														
	Ground Turkey (19)	10.5	0.0	[0.0 - 17.6]														
	Chickens (28)	7.1	3.6	[0.1 - 18.3]														
Macrolides																		
Azithromycin	Humans (101)	0.0	10.9	[5.6 - 18.7]														
	Chicken Breasts (181)	0.0	9.9	[6.0 - 15.3]														
	Ground Turkey (19)	0.0	5.3	[0.1 - 26.0]														
	Chickens (28)	0.0	10.7	[2.3 - 28.2]														
Erythromycin	Humans (101)	0.0	10.9	[5.6 - 18.7]														
	Chicken Breasts (181)	0.0	9.9	[6.0 - 15.3]														
	Ground Turkey (19)	0.0	5.3	[0.1 - 26.0]														
	Chickens (28)	0.0	10.7	[2.3 - 28.2]														

¹ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

² Percent of isolates with intermediate susceptibility

³ Percent resistant; for florfenicol, percent non-susceptible

⁴ 95% confidence intervals for percent resistant (%R) were 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 areas 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

Table 56b. Distribution of MICs and Occurrence of Resistance among *Campylobacter coli* Isolates from Humans, Retail Meats, and Chickens, 2008

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					
Phenicol																								
Florfenicol ⁶	Humans (101)	N/A	0.0	[0.0 - 3.6]												6.9	56.4	32.7	4.0					
	Chicken Breasts (181)	N/A	0.0	[0.0 - 2.0]												6.6	63.0	29.3	1.1					
	Ground Turkey (19)	N/A	0.0	[0.0 - 17.6]												15.8	52.6	26.3	5.3					
	Chickens (28)	N/A	0.0	[0.0 - 12.3]												21.4	78.6							
Quinolones																								
Ciprofloxacin	Humans (101)	0.0	30.7	[21.9 - 40.7]												15.8	31.7	15.8	5.9	1.0	9.9	14.9	3.0	2.0
	Chicken Breasts (181)	0.0	20.4	[14.8 - 27.1]												7.2	45.9	25.4	1.1	0.6	4.4	12.2	3.3	
	Ground Turkey (19)	0.0	47.4	[24.4 - 71.1]												10.5	5.3	31.6	5.3	5.3	26.3	15.8		
	Chickens (28)	0.0	14.3	[4.0 - 32.7]												35.7	42.9	7.1	3.6	3.6	7.1			
Nalidixic acid	Humans (101)	0.0	30.7	[21.9 - 40.7]												41.6	20.8	6.9	6.9	23.8				
	Chicken Breasts (181)	0.0	20.4	[14.8 - 27.1]												47.5	31.5	0.6	5.5	14.9				
	Ground Turkey (19)	0.0	47.4	[24.4 - 71.1]												31.6	21.1	15.8	31.6					
	Chickens (28)	0.0	14.3	[4.0 - 32.7]												82.1	3.6	7.1	7.1					
Tetracyclines																								
Tetracycline	Humans (101)	0.0	39.6	[30.0 - 49.8]												2.0	13.9	26.7	11.9	5.9	1.0	4.0	34.7	
	Chicken Breasts (181)	0.6	46.4	[39.0 - 54.0]												0.6	24.9	21.6	3.3	1.7	1.1	0.6	2.8	43.7
	Ground Turkey (19)	0.0	94.7	[74.0 - 99.9]												5.3	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
	Chickens (28)	0.0	60.7	[40.6 - 78.5]												7.1	28.6	3.6	3.6	3.6	10.7	42.9		

¹ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

² Percent of isolates with intermediate susceptibility

³ Percent resistant; for florfenicol, percent non-susceptible

⁴ 95% confidence intervals for percent resistant (%R) were 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 areas 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

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 57a. Antimicrobial Resistance among *Campylobacter coli* Isolates from Humans, Retail Meats, and Chickens, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	6	8	20	12	17	25	22	26	98	97	105	101	
	Chicken Breasts						90	142	196	151	145	143	181	
	Ground Turkey						2	1	5	9	10	14	19	
	Chickens					52 ¹	288	247	186	380	123	76	28	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint) ²	Isolate Source ³												
Aminoglycosides	Gentamicin (MIC ≥ 8 µg/ml)	Humans		0.0%	0.0%	8.3%	0.0%	0.0%	4.5%	0.0%	2.0%	1.0%	0.0%	1.0%
		Chicken Breasts						0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	1.7%
		Ground Turkey						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Chickens					0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	1.3%	3.6%
Ketolides	Telithromycin (MIC ≥ 16 µg/ml)	Humans								4.1%	7.2%	5.7%	5.9%	
		Chicken Breasts							8.2%	7.9%	4.8%	7.0%	7.7%	
		Ground Turkey							0.0%	22.2%	0.0%	0.0%	5.3%	
		Chickens								5.5%	6.5%	13.2%	3.6%	
Lincosamides	Clindamycin (MIC ≥ 8 µg/ml)	Humans	16.7%	12.5%	10.0%	8.3%	5.9%	4.0%	9.1%	0.0%	4.1%	9.3%	5.7%	9.9%
		Chicken Breasts								7.1%	8.6%	4.8%	4.9%	5.0%
		Ground Turkey								0.0%	0.0%	0.0%	0.0%	0.0%
		Chickens					1.9%	4.9%	4.5%	1.1%	2.4%	1.6%	9.2%	3.6%
Macrolides	Azithromycin (MIC ≥ 8 µg/ml)	Humans		12.5%	10.0%	8.3%	5.9%	4.0%	9.1%	0.0%	3.1%	8.2%	5.7%	10.9%
		Chicken Breasts								9.2%	9.9%	5.5%	6.3%	9.9%
		Ground Turkey								0.0%	22.2%	0.0%	0.0%	5.3%
		Chickens					11.5%	19.4%	20.2%	9.1%	8.4%	8.9%	14.5%	10.7%
	Erythromycin (MIC ≥ 32 µg/ml)	Humans	0.0%	12.5%	10.0%	8.3%	5.9%	4.0%	9.1%	0.0%	3.1%	8.2%	5.7%	10.9%
		Chicken Breasts						7.8%	7.0%	9.2%	9.9%	5.5%	6.3%	9.9%
		Ground Turkey						0.0%	0.0%	0.0%	22.2%	0.0%	0.0%	5.3%
		Chickens					9.6%	18.8%	20.2%	9.1%	8.4%	8.9%	14.5%	10.7%
Phenicolis	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	50.0%	37.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%				
		Chickens					0.0%	0.0%	0.0%	0.0%				
	Florfenicol (MIC > 4) ⁴	Humans									1.0%	0.0%	0.0%	0.0%
		Chickens									0.0%	0.0%	0.0%	0.0%

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

² Resistance figures for gentamicin, clindamycin, azithromycin, erythromycin, nalidixic acid, and doxycycline in this report may differ from previously published figures because breakpoints have been revised for these antimicrobials

³ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

⁴ 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

Table 57b. Antimicrobial Resistance among *Campylobacter coli* Isolates from Humans, Retail Meats, and Chickens, by Year, 1997-2008

Year		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Humans	6	8	20	12	17	25	22	26	98	97	105	101	
	Chicken Breasts						90	142	196	151	145	143	181	
	Ground Turkey						2	1	5	9	10	14	19	
	Chickens					52 ¹	288	247	186	380	123	76	28	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)²	Isolate Source³												
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	23.5% 23	21.6% 21	28.6% 30	30.7% 31
		Chicken Breasts						10.0% 9	13.4% 19	16.3% 32	29.1% 44	22.1% 32	25.9% 37	20.4% 37
		Ground Turkey						50.0% 1	100.0% 1	0.0% 0	55.6% 5	30.0% 3	50.0% 7	47.4% 9
		Chickens					19.2% 10	16.0% 46	20.2% 50	26.9% 50	22.1% 84	15.4% 19	15.8% 12	14.3% 4
	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	26.5% 26	23.7% 23	30.5% 32	30.7% 31
		Chicken Breasts								16.3% 32	29.1% 44	20.7% 30	25.9% 37	20.4% 37
		Ground Turkey								0.0% 0	55.6% 5	30.0% 3	50.0% 7	47.4% 9
		Chickens					19.2% 10	17.7% 51	21.5% 53	27.4% 51	22.1% 84	15.4% 19	15.8% 12	14.3% 4
Tetracyclines	Doxycycline (MIC ≥ 8 µg/ml)	Chicken Breasts					44.4% 40	50.7% 72						
		Ground Turkey					50.0% 1	100.0% 1						
	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	30.6% 30	39.2% 38	41.9% 44	39.6% 40
		Chicken Breasts								46.4% 91	42.4% 64	46.9% 68	39.9% 57	46.4% 84
		Ground Turkey								0.0% 0	88.9% 8	80.0% 8	64.3% 9	94.7% 18
		Chickens					57.7% 30	49.0% 141	51.0% 126	48.4% 90	42.1% 160	53.7% 66	42.1% 32	60.7% 17

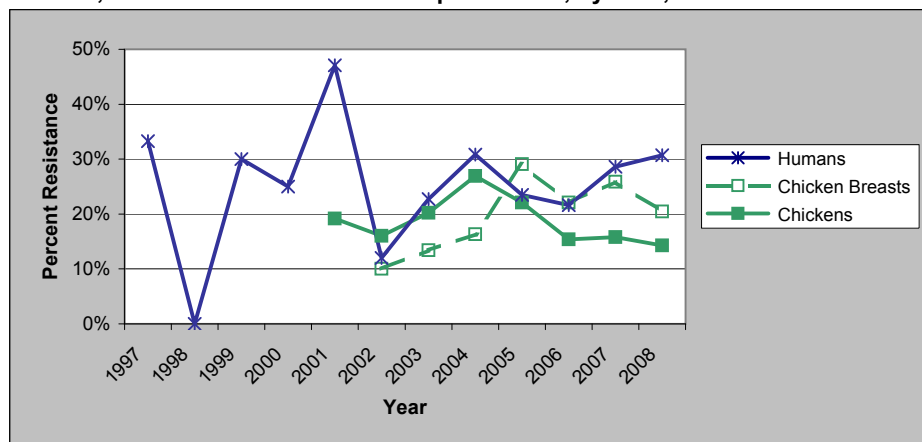
¹ These isolates were recovered from July through December, 2001, when the new ARS isolation method was used

² Resistance figures for gentamicin, clindamycin, azithromycin, erythromycin, nalidixic acid, and doxycycline in this report may differ from previously published figures because breakpoints have been revised for these antimicrobials

³ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

Ciprofloxacin Resistance

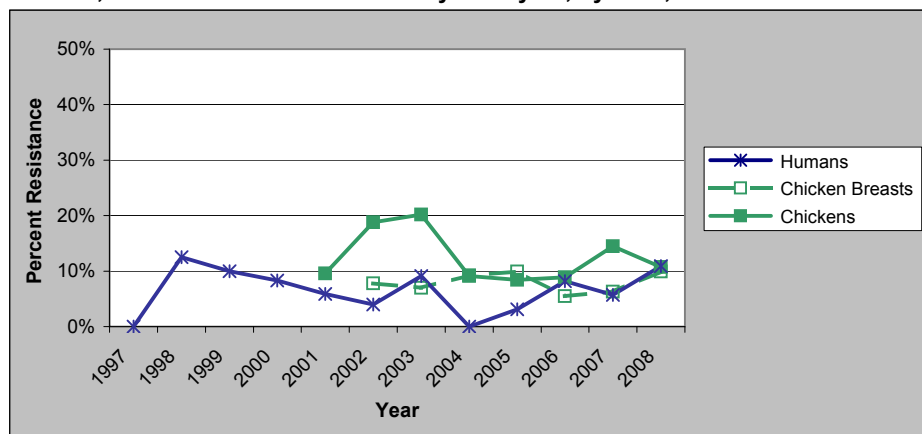
Figure 23. Percent of *Campylobacter coli* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Ciprofloxacin, by Year, 1997-2008¹



¹ Data for ground turkey, ground beef, 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 57 contains resistance data for *C. coli* isolates from each source, by year

Erythromycin Resistance

Figure 24. Percent of *Campylobacter coli* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Erythromycin, by Year, 1997-2008¹



¹ Data for ground turkey, ground beef, 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 57 contains resistance data for *C. coli* isolates from each source, by year

Table 58. Number of *Campylobacter coli* Isolates Tested from Humans, Retail Meats¹, and Chickens, by Year, 1997-2008

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Humans	6	8	20	12	17	25	22	26	98	97	105	101
Chicken Breasts						90	142	196	151	145	143	181
Ground Turkey						2	1	5	9	10	14	19
Chickens					52 ²	288	247	186	380	123	76	28

¹ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

² These isolates were recovered from July through December 2001, when the new ARS isolation method was used

Table 59. Resistance Patterns among *Campylobacter coli* Isolates from Humans, Retail Meats and Food Animals, by Year, 2004-2008¹

Year		2004	2005	2006	2007	2008
Number of Isolates Tested	Humans	N/A ¹	98	97	105	101
	Chicken Breasts	196	151	145	143	181
	Ground Turkey	5	9	10	14	19
	Chickens	N/A ¹	380	123	76	28
Resistance Patterns	Isolate Source²					
1. No Resistance Detected	Humans		51.0% 50	45.4% 44	41.0% 43	41.6% 42
	Chicken Breasts	38.3% 75	36.4% 55	38.6% 56	45.5% 65	41.4% 75
	Ground Turkey	100.0% 5	11.1% 1	20.0% 2	28.6% 4	5.3% 1
	Chickens		47.6% 181	39.0% 48	43.4% 33	28.6% 8
2. Resistance to ≥ 2 Antimicrobial Classes	Humans		12.2% 12	16.5% 16	18.1% 19	24.8% 25
	Chicken Breasts	15.3% 30	19.9% 30	15.2% 22	19.6% 28	24.3% 44
	Ground Turkey	0.0% 0	55.6% 5	30.0% 3	42.9% 6	52.6% 10
	Chickens		21.6% 82	17.9% 22	21.1% 16	17.9% 5
3. Resistance to ≥ 3 Antimicrobial Classes	Humans		3.1% 3	7.2% 7	5.7% 6	5.9% 6
	Chicken Breasts	8.2% 16	9.3% 14	5.5% 8	7.0% 10	6.1% 11
	Ground Turkey	0.0% 0	22.2% 2	0.0% 0	0.0% 0	5.3% 1
	Chickens		5.8% 22	6.5% 8	13.2% 10	7.1% 2
4. Resistance to ≥ 4 Antimicrobial Classes	Humans		1.0% 1	2.1% 2	1.0% 1	2.0% 2
	Chicken Breasts	1.5% 3	4.6% 7	2.1% 3	2.8% 4	2.2% 4
	Ground Turkey	0.0% 0	22.2% 2	0.0% 0	0.0% 0	0.0% 0
	Chickens		1.3% 5	0.8% 1	3.9% 3	0.0% 0
5. At Least Quinolone and Macrolide Resistant	Humans		1.0% 1	3.1% 3	1.9% 2	4.0% 4
	Chicken Breasts	0.5% 1	1.3% 2	0.0% 0	1.4% 2	1.1% 2
	Ground Turkey	0.0% 0	22.2% 2	0.0% 0	0.0% 0	0.0% 0
	Chickens		1.6% 6	1.6% 2	5.3% 4	0.0% 0
6. At Least Quinolone and Tetracycline Resistant	Humans		9.2% 9	10.3% 10	13.3% 14	16.8% 17
	Chicken Breasts	7.1% 14	11.3% 17	10.3% 15	14.7% 21	13.3% 24
	Ground Turkey	0.0% 0	55.6% 5	30.0% 3	42.9% 6	47.4% 9
	Chickens		13.9% 53	9.8% 12	10.5% 8	14.3% 4

¹ Data are reported for retail meats beginning in 2004 and for humans and chickens beginning in 2005

² Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for these retail meats can be found in prior reports

V. *Escherichia coli* Data

A. *E. coli* Isolates Tested

Table 60. Number of *E. coli* Isolates Tested, by Source and Year, 2000-2008

Source	Year								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Chicken Breasts			282	396	400	393	418	299	306
Ground Turkey			304	333	376	396	388	315	300
Ground Beef			295	311	338	316	295	256	250
Pork Chops			184	218	232	205	182	152	146
Chickens	285	1989	2100	1365	1697	2232	1357	1510	986

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

Table 61. Number and Percent of Retail Meat Samples Culture Positive for *E. coli*, 2008

	Chicken Breasts	Ground Turkey	Ground Beef	Pork Chops
Number of Meat Samples Tested	360	360	360	360
Number Positive for <i>E. coli</i>	306	300	250	146
Percent Positive for <i>E. coli</i>	85.0%	83.3%	69.4%	40.6%

Figure 25. Percent of Retail Meat Samples Culture Positive for *E. coli*, 2008

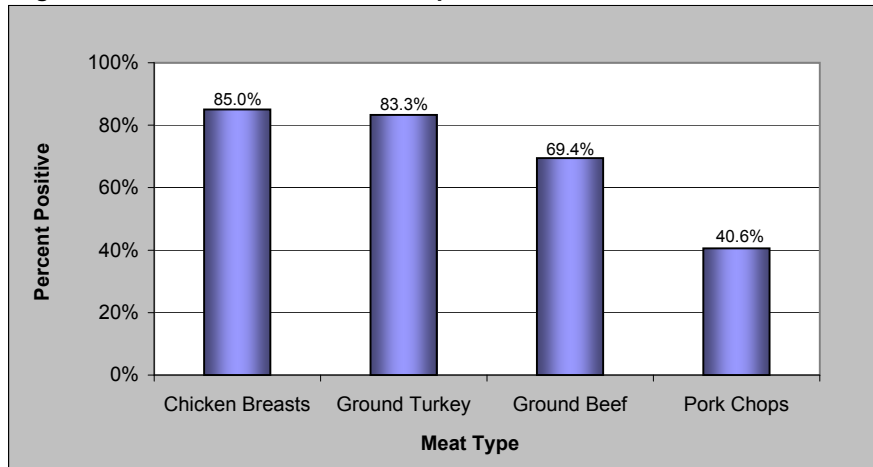
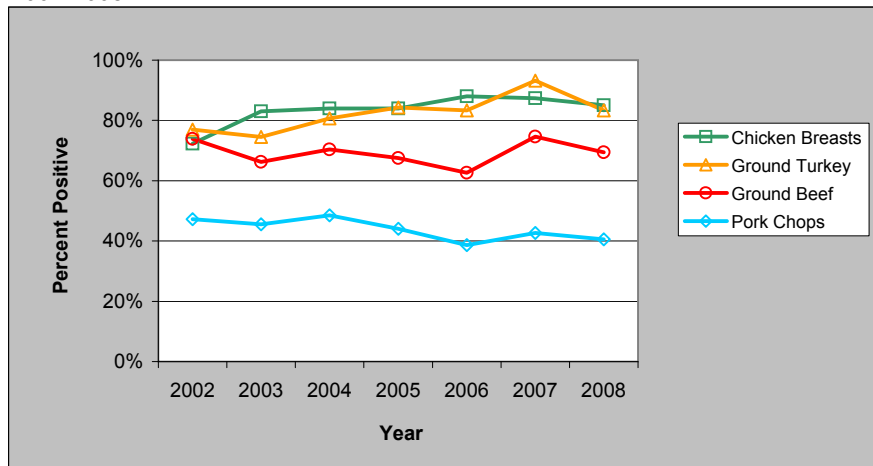


Figure 26. Percent of Retail Meat Samples Culture Positive for *E. coli*, 2002-2008



C. Antimicrobial Susceptibility among *E. coli*

MIC Distributions

Table 62a. Distribution of MICs and Occurrence of Resistance among *E. coli* Isolates from Retail Meats and Chickens, 2008

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
Aminoglycosides																			
Amikacin	Chicken Breasts (306)	0.0	0.0	[0.0 - 1.2]							0.7	48.7	46.4	4.3					
	Ground Turkey (300)	0.0	0.0	[0.0 - 1.2]							0.7	54.7	41.0	3.7					
	Ground Beef (250)	0.0	0.0	[0.0 - 1.5]								47.6	48.4	3.6	0.4				
	Pork Chops (146)	0.0	0.0	[0.0 - 2.5]							0.7	41.8	48.6	7.5	1.4				
	Chickens (986)	0.0	0.0	[0.0 - 0.4]							1.1	11.9	64.1	21.5	1.4				
Gentamicin	Chicken Breasts (306)	1.3	34.0	[28.7 - 39.6]							15.7	45.8	2.9	0.3	1.3	3.6	30.4		
	Ground Turkey (300)	1.7	37.0	[31.5 - 42.7]	0.3						15.3	39.3	6.3		1.7	7.0	30.0		
	Ground Beef (250)	0.0	2.0	[0.7 - 4.6]							26.0	68.0	4.0			0.4	1.6		
	Pork Chops (146)	0.7	1.4	[0.2 - 4.9]							22.6	62.3	12.3	0.7	0.7	0.7	0.7		
	Chickens (986)	3.4	44.5	[41.4 - 47.7]							2.4	25.1	22.9	1.3	0.3	3.4	9.7	34.8	
Kanamycin	Chicken Breasts (306)	2.6	6.9	[4.3 - 10.3]											74.8	15.7	2.6	0.3	6.5
	Ground Turkey (300)	1.3	19.0	[14.7 - 23.9]											69.0	10.7	1.3	0.3	18.7
	Ground Beef (250)	0.4	4.0	[1.9 - 7.2]											94.4	1.2	0.4		4.0
	Pork Chops (146)	0.0	6.2	[2.9 - 11.4]											91.8	2.1			6.2
	Chickens (986)	5.0	10.2	[8.4 - 12.3]											72.0	12.8	5.0	0.7	9.5
Streptomycin	Chicken Breasts (306)	N/A	43.8	[38.2 - 49.6]													56.2	13.7	30.1
	Ground Turkey (300)	N/A	57.3	[51.5 - 63.0]													42.7	14.7	42.7
	Ground Beef (250)	N/A	10.4	[6.9 - 14.9]													89.6	3.6	6.8
	Pork Chops (146)	N/A	19.9	[13.7 - 27.3]													80.1	5.5	14.4
	Chickens (986)	N/A	54.6	[51.4 - 57.7]													45.4	17.0	37.5
β-Lactam/β-Lactamase Inhibitor Combinations																			
Amoxicillin-Clavulanic Acid	Chicken Breasts (306)	2.9	11.8	[8.4 - 15.9]							2.3	21.2	41.8	19.9	2.9	7.5	4.3		
	Ground Turkey (300)	21.3	8.3	[5.5 - 12.1]								8.0	29.7	32.7	21.3	6.7	1.7		
	Ground Beef (250)	2.0	2.4	[0.9 - 5.2]							2.0	18.8	57.6	17.2	2.0	0.8	1.6		
	Pork Chops (146)	0.7	3.4	[1.1 - 7.8]							1.4	20.6	42.5	31.5	0.7	3.4			
	Chickens (986)	0.9	13.7	[11.6 - 16.0]							3.4	31.5	39.8	10.6	0.9	12.0	1.7		
Cephems																			
Cefoxitin	Chicken Breasts (306)	2.3	11.8	[8.4 - 15.9]							1.3	8.8	57.2	18.6	2.3	3.9	7.8		
	Ground Turkey (300)	1.7	6.3	[3.9 - 9.7]							0.3	14.7	59.3	17.7	1.7	2.0	4.3		
	Ground Beef (250)	0.4	2.4	[0.9 - 5.2]							2.0	22.0	62.8	10.4	0.4	0.4	2.0		
	Pork Chops (146)	2.7	3.4	[1.1 - 7.8]								17.1	63.7	13.0	2.7	0.7	2.7		
	Chickens (986)	1.8	13.8	[11.7 - 16.1]							0.1	1.6	18.9	51.4	12.4	1.8	6.8	7.0	

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates that were resistant

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

⁴ 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 areas 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

Table 62b. Distribution of MICs and Occurrence of Resistance among *E. coli* Isolates from Retail Meats and Chickens, 2008

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																																																																																											
Cepheems																																																																																																																
Ceftiofur	Chicken Breasts (306)	0.3	10.8	[7.5 - 14.8]	<table border="1"> <tr> <td>1.3</td><td>22.9</td><td>58.5</td><td>5.9</td><td>0.3</td><td>0.3</td><td>7.5</td><td>3.3</td><td colspan="10"></td> </tr> <tr> <td>0.7</td><td>17.7</td><td>71.0</td><td>4.7</td><td>1.7</td><td>0.7</td><td>1.0</td><td>2.7</td><td colspan="10"></td> </tr> <tr> <td>3.2</td><td>24.0</td><td>69.2</td><td>1.6</td><td>0.4</td><td></td><td>0.8</td><td>0.8</td><td colspan="10"></td> </tr> <tr> <td>0.7</td><td>29.5</td><td>64.4</td><td>2.1</td><td></td><td></td><td></td><td>3.4</td><td colspan="10"></td> </tr> <tr> <td>3.8</td><td>44.2</td><td>35.6</td><td>2.4</td><td>0.4</td><td>3.1</td><td>6.7</td><td>3.8</td><td colspan="10"></td> </tr> </table>														1.3	22.9	58.5	5.9	0.3	0.3	7.5	3.3											0.7	17.7	71.0	4.7	1.7	0.7	1.0	2.7											3.2	24.0	69.2	1.6	0.4		0.8	0.8											0.7	29.5	64.4	2.1				3.4											3.8	44.2	35.6	2.4	0.4	3.1	6.7	3.8														
	1.3	22.9	58.5	5.9	0.3	0.3	7.5	3.3																																																																																																								
	0.7	17.7	71.0	4.7	1.7	0.7	1.0	2.7																																																																																																								
	3.2	24.0	69.2	1.6	0.4		0.8	0.8																																																																																																								
	0.7	29.5	64.4	2.1				3.4																																																																																																								
3.8	44.2	35.6	2.4	0.4	3.1	6.7	3.8																																																																																																									
Ground Turkey (300)	0.7	3.7	[1.8 - 6.5]	<table border="1"> <tr> <td>0.7</td><td>17.7</td><td>71.0</td><td>4.7</td><td>1.7</td><td>0.7</td><td>1.0</td><td>2.7</td><td colspan="10"></td> </tr> </table>														0.7	17.7	71.0	4.7	1.7	0.7	1.0	2.7																																																																																							
0.7	17.7	71.0	4.7	1.7	0.7	1.0	2.7																																																																																																									
Ground Beef (250)	0.0	1.6	[0.4 - 4.0]	<table border="1"> <tr> <td>3.2</td><td>24.0</td><td>69.2</td><td>1.6</td><td>0.4</td><td></td><td>0.8</td><td>0.8</td><td colspan="10"></td> </tr> </table>														3.2	24.0	69.2	1.6	0.4		0.8	0.8																																																																																							
3.2	24.0	69.2	1.6	0.4		0.8	0.8																																																																																																									
Pork Chops (146)	0.0	3.4	[1.1 - 7.8]	<table border="1"> <tr> <td>0.7</td><td>29.5</td><td>64.4</td><td>2.1</td><td></td><td></td><td></td><td>3.4</td><td colspan="10"></td> </tr> </table>														0.7	29.5	64.4	2.1				3.4																																																																																							
0.7	29.5	64.4	2.1				3.4																																																																																																									
Chickens (986)	3.1	10.4	[8.6 - 12.5]	<table border="1"> <tr> <td>3.8</td><td>44.2</td><td>35.6</td><td>2.4</td><td>0.4</td><td>3.1</td><td>6.7</td><td>3.8</td><td colspan="10"></td> </tr> </table>														3.8	44.2	35.6	2.4	0.4	3.1	6.7	3.8																																																																																							
3.8	44.2	35.6	2.4	0.4	3.1	6.7	3.8																																																																																																									
Ceftriaxone ⁵	Chicken Breasts (306)	0.3	11.1	[7.8 - 15.2]	<table border="1"> <tr> <td>88.6</td><td></td><td></td><td></td><td></td><td>0.3</td><td>0.7</td><td>5.9</td><td>4.3</td><td>0.3</td><td colspan="7"></td> </tr> <tr> <td>93.0</td><td>0.3</td><td>2.0</td><td>1.0</td><td></td><td></td><td>2.0</td><td>1.3</td><td>0.3</td><td colspan="7"></td> </tr> <tr> <td>98.0</td><td></td><td></td><td></td><td></td><td>0.4</td><td></td><td>0.8</td><td>0.4</td><td>0.4</td><td colspan="7"></td> </tr> <tr> <td>96.6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2.7</td><td>0.7</td><td colspan="7"></td> </tr> <tr> <td>85.5</td><td>0.7</td><td>0.1</td><td>0.2</td><td></td><td>2.5</td><td>5.2</td><td>4.9</td><td>0.9</td><td colspan="7"></td> </tr> </table>														88.6					0.3	0.7	5.9	4.3	0.3								93.0	0.3	2.0	1.0			2.0	1.3	0.3								98.0					0.4		0.8	0.4	0.4								96.6								2.7	0.7								85.5	0.7	0.1	0.2		2.5	5.2	4.9	0.9																		
	88.6					0.3	0.7	5.9	4.3	0.3																																																																																																						
	93.0	0.3	2.0	1.0			2.0	1.3	0.3																																																																																																							
	98.0					0.4		0.8	0.4	0.4																																																																																																						
	96.6								2.7	0.7																																																																																																						
85.5	0.7	0.1	0.2		2.5	5.2	4.9	0.9																																																																																																								
Ground Turkey (300)	1.0	3.7	[1.8 - 6.5]	<table border="1"> <tr> <td>93.0</td><td>0.3</td><td>2.0</td><td>1.0</td><td></td><td></td><td>2.0</td><td>1.3</td><td>0.3</td><td colspan="7"></td> </tr> </table>														93.0	0.3	2.0	1.0			2.0	1.3	0.3																																																																																						
93.0	0.3	2.0	1.0			2.0	1.3	0.3																																																																																																								
Ground Beef (250)	0.4	1.6	[0.4 - 4.0]	<table border="1"> <tr> <td>98.0</td><td></td><td></td><td></td><td></td><td>0.4</td><td></td><td>0.8</td><td>0.4</td><td>0.4</td><td colspan="7"></td> </tr> </table>														98.0					0.4		0.8	0.4	0.4																																																																																					
98.0					0.4		0.8	0.4	0.4																																																																																																							
Pork Chops (146)	0.0	3.4	[1.1 - 7.8]	<table border="1"> <tr> <td>96.6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2.7</td><td>0.7</td><td colspan="7"></td> </tr> </table>														96.6								2.7	0.7																																																																																					
96.6								2.7	0.7																																																																																																							
Chickens (986)	0.2	13.5	[11.4 - 15.8]	<table border="1"> <tr> <td>85.5</td><td>0.7</td><td>0.1</td><td>0.2</td><td></td><td>2.5</td><td>5.2</td><td>4.9</td><td>0.9</td><td colspan="7"></td> </tr> </table>														85.5	0.7	0.1	0.2		2.5	5.2	4.9	0.9																																																																																						
85.5	0.7	0.1	0.2		2.5	5.2	4.9	0.9																																																																																																								
Folate Pathway Inhibitors																																																																																																																
Sulfisoxazole	Chicken Breasts (306)	N/A	39.2	[33.7 - 44.9]	<table border="1"> <tr> <td colspan="7"></td><td>47.1</td><td>13.4</td><td>0.3</td><td colspan="4"></td><td>39.2</td> </tr> <tr> <td colspan="7"></td><td>34.0</td><td>14.7</td><td>0.3</td><td colspan="4"></td><td>51.0</td> </tr> <tr> <td colspan="7"></td><td>80.4</td><td>7.6</td><td>0.4</td><td colspan="4"></td><td>11.6</td> </tr> <tr> <td colspan="7"></td><td>65.8</td><td>17.8</td><td colspan="4"></td><td>16.4</td> </tr> <tr> <td colspan="7"></td><td colspan="3"></td><td>43.2</td><td>3.5</td><td>0.4</td><td colspan="4"></td><td>0.1</td><td>52.7</td> </tr> </table>																					47.1	13.4	0.3					39.2								34.0	14.7	0.3					51.0								80.4	7.6	0.4					11.6								65.8	17.8					16.4											43.2	3.5	0.4					0.1	52.7																
								47.1	13.4	0.3					39.2																																																																																																	
								34.0	14.7	0.3					51.0																																																																																																	
								80.4	7.6	0.4					11.6																																																																																																	
								65.8	17.8					16.4																																																																																																		
										43.2	3.5	0.4					0.1	52.7																																																																																														
Ground Turkey (300)	N/A	51.0	[45.2 - 56.8]	<table border="1"> <tr> <td colspan="7"></td><td>34.0</td><td>14.7</td><td>0.3</td><td colspan="4"></td><td>51.0</td> </tr> </table>																					34.0	14.7	0.3					51.0																																																																																
							34.0	14.7	0.3					51.0																																																																																																		
Ground Beef (250)	N/A	11.6	[7.9 - 16.2]	<table border="1"> <tr> <td colspan="7"></td><td>80.4</td><td>7.6</td><td>0.4</td><td colspan="4"></td><td>11.6</td> </tr> </table>																					80.4	7.6	0.4					11.6																																																																																
							80.4	7.6	0.4					11.6																																																																																																		
Pork Chops (146)	N/A	16.4	[10.8 - 23.5]	<table border="1"> <tr> <td colspan="7"></td><td>65.8</td><td>17.8</td><td colspan="4"></td><td>16.4</td> </tr> </table>																					65.8	17.8					16.4																																																																																	
							65.8	17.8					16.4																																																																																																			
Chickens (986)	N/A	52.7	[49.6 - 55.9]	<table border="1"> <tr> <td colspan="7"></td><td colspan="3"></td><td>43.2</td><td>3.5</td><td>0.4</td><td colspan="4"></td><td>0.1</td><td>52.7</td> </tr> </table>																								43.2	3.5	0.4					0.1	52.7																																																																												
										43.2	3.5	0.4					0.1	52.7																																																																																														
Trimethoprim-Sulfamethoxazole	Chicken Breasts (306)	N/A	3.6	[1.8 - 6.3]	<table border="1"> <tr> <td>69.0</td><td>20.6</td><td>4.6</td><td>1.6</td><td>0.7</td><td></td><td></td><td>3.6</td><td colspan="7"></td> </tr> <tr> <td>55.0</td><td>24.0</td><td>10.3</td><td>3.7</td><td>1.7</td><td></td><td></td><td>5.3</td><td colspan="7"></td> </tr> <tr> <td>80.0</td><td>13.6</td><td>4.0</td><td>0.4</td><td></td><td></td><td></td><td>2.0</td><td colspan="7"></td> </tr> <tr> <td>68.5</td><td>21.2</td><td>2.1</td><td>0.7</td><td>1.4</td><td></td><td></td><td>6.2</td><td colspan="7"></td> </tr> <tr> <td>60.6</td><td>19.4</td><td>5.7</td><td>4.3</td><td>0.9</td><td></td><td></td><td>9.1</td><td colspan="7"></td> </tr> </table>														69.0	20.6	4.6	1.6	0.7			3.6								55.0	24.0	10.3	3.7	1.7			5.3								80.0	13.6	4.0	0.4				2.0								68.5	21.2	2.1	0.7	1.4			6.2								60.6	19.4	5.7	4.3	0.9			9.1																										
	69.0	20.6	4.6	1.6	0.7			3.6																																																																																																								
	55.0	24.0	10.3	3.7	1.7			5.3																																																																																																								
	80.0	13.6	4.0	0.4				2.0																																																																																																								
	68.5	21.2	2.1	0.7	1.4			6.2																																																																																																								
60.6	19.4	5.7	4.3	0.9			9.1																																																																																																									
Ground Turkey (300)	N/A	5.3	[3.1 - 8.5]	<table border="1"> <tr> <td>55.0</td><td>24.0</td><td>10.3</td><td>3.7</td><td>1.7</td><td></td><td></td><td>5.3</td><td colspan="7"></td> </tr> </table>														55.0	24.0	10.3	3.7	1.7			5.3																																																																																							
55.0	24.0	10.3	3.7	1.7			5.3																																																																																																									
Ground Beef (250)	N/A	2.0	[0.7 - 4.6]	<table border="1"> <tr> <td>80.0</td><td>13.6</td><td>4.0</td><td>0.4</td><td></td><td></td><td></td><td>2.0</td><td colspan="7"></td> </tr> </table>														80.0	13.6	4.0	0.4				2.0																																																																																							
80.0	13.6	4.0	0.4				2.0																																																																																																									
Pork Chops (146)	N/A	6.2	[2.9 - 11.4]	<table border="1"> <tr> <td>68.5</td><td>21.2</td><td>2.1</td><td>0.7</td><td>1.4</td><td></td><td></td><td>6.2</td><td colspan="7"></td> </tr> </table>														68.5	21.2	2.1	0.7	1.4			6.2																																																																																							
68.5	21.2	2.1	0.7	1.4			6.2																																																																																																									
Chickens (986)	N/A	9.1	[7.4 - 11.1]	<table border="1"> <tr> <td>60.6</td><td>19.4</td><td>5.7</td><td>4.3</td><td>0.9</td><td></td><td></td><td>9.1</td><td colspan="7"></td> </tr> </table>														60.6	19.4	5.7	4.3	0.9			9.1																																																																																							
60.6	19.4	5.7	4.3	0.9			9.1																																																																																																									
Penicillins																																																																																																																
Ampicillin	Chicken Breasts (306)	0.0	23.5	[18.9 - 28.7]	<table border="1"> <tr> <td colspan="5"></td><td>5.9</td><td>35.6</td><td>33.3</td><td>1.6</td><td></td><td></td><td>0.3</td><td>23.2</td><td colspan="5"></td> </tr> <tr> <td colspan="5"></td><td>2.0</td><td>20.7</td><td>19.3</td><td></td><td></td><td></td><td></td><td></td><td>58.0</td><td colspan="5"></td> </tr> <tr> <td colspan="5"></td><td>4.8</td><td>41.2</td><td>45.6</td><td>2.0</td><td></td><td></td><td></td><td>0.4</td><td>6.0</td><td colspan="5"></td> </tr> <tr> <td colspan="5"></td><td>8.2</td><td>30.8</td><td>42.5</td><td>3.4</td><td></td><td></td><td></td><td></td><td>15.1</td><td colspan="5"></td> </tr> <tr> <td colspan="5"></td><td>10.5</td><td>40.8</td><td>23.4</td><td>1.7</td><td></td><td></td><td></td><td>0.5</td><td>23.0</td><td colspan="5"></td> </tr> </table>																			5.9	35.6	33.3	1.6			0.3	23.2											2.0	20.7	19.3						58.0											4.8	41.2	45.6	2.0				0.4	6.0											8.2	30.8	42.5	3.4					15.1											10.5	40.8	23.4	1.7				0.5	23.0					
						5.9	35.6	33.3	1.6			0.3	23.2																																																																																																			
						2.0	20.7	19.3						58.0																																																																																																		
						4.8	41.2	45.6	2.0				0.4	6.0																																																																																																		
						8.2	30.8	42.5	3.4					15.1																																																																																																		
					10.5	40.8	23.4	1.7				0.5	23.0																																																																																																			
Ground Turkey (300)	0.0	58.0	[52.2 - 63.6]	<table border="1"> <tr> <td colspan="5"></td><td>2.0</td><td>20.7</td><td>19.3</td><td></td><td></td><td></td><td></td><td></td><td>58.0</td><td colspan="5"></td> </tr> </table>																			2.0	20.7	19.3						58.0																																																																																	
					2.0	20.7	19.3						58.0																																																																																																			
Ground Beef (250)	0.0	6.4	[3.7 - 10.2]	<table border="1"> <tr> <td colspan="5"></td><td>4.8</td><td>41.2</td><td>45.6</td><td>2.0</td><td></td><td></td><td></td><td>0.4</td><td>6.0</td><td colspan="5"></td> </tr> </table>																			4.8	41.2	45.6	2.0				0.4	6.0																																																																																	
					4.8	41.2	45.6	2.0				0.4	6.0																																																																																																			
Pork Chops (146)	0.0	15.1	[9.7 - 21.9]	<table border="1"> <tr> <td colspan="5"></td><td>8.2</td><td>30.8</td><td>42.5</td><td>3.4</td><td></td><td></td><td></td><td></td><td>15.1</td><td colspan="5"></td> </tr> </table>																			8.2	30.8	42.5	3.4					15.1																																																																																	
					8.2	30.8	42.5	3.4					15.1																																																																																																			
Chickens (986)	0.0	23.5	[20.9 - 26.3]	<table border="1"> <tr> <td colspan="5"></td><td>10.5</td><td>40.8</td><td>23.4</td><td>1.7</td><td></td><td></td><td></td><td>0.5</td><td>23.0</td><td colspan="5"></td> </tr> </table>																			10.5	40.8	23.4	1.7				0.5	23.0																																																																																	
					10.5	40.8	23.4	1.7				0.5	23.0																																																																																																			
Phenicol																																																																																																																
Chloramphenicol	Chicken Breasts (306)	1.0	1.0	[0.2 - 2.8]	<table border="1"> <tr> <td colspan="5"></td><td>1.6</td><td>42.5</td><td>53.9</td><td>1.0</td><td></td><td></td><td></td><td>1.0</td><td colspan="5"></td> </tr> <tr> <td colspan="5"></td><td>1.7</td><td>43.3</td><td>50.3</td><td>1.0</td><td></td><td></td><td></td><td></td><td>3.7</td><td colspan="5"></td> </tr> <tr> <td colspan="5"></td><td>2.8</td><td>32.4</td><td>62.4</td><td>1.6</td><td></td><td></td><td></td><td></td><td>0.8</td><td colspan="5"></td> </tr> <tr> <td colspan="5"></td><td>0.7</td><td>33.6</td><td>58.9</td><td>3.4</td><td></td><td></td><td></td><td>0.7</td><td>2.7</td><td colspan="5"></td> </tr> <tr> <td colspan="5"></td><td>9.5</td><td>65.4</td><td>23.4</td><td>0.6</td><td></td><td></td><td></td><td></td><td>1.0</td><td colspan="5"></td> </tr> </table>																			1.6	42.5	53.9	1.0				1.0											1.7	43.3	50.3	1.0					3.7											2.8	32.4	62.4	1.6					0.8											0.7	33.6	58.9	3.4				0.7	2.7											9.5	65.4	23.4	0.6					1.0					
						1.6	42.5	53.9	1.0				1.0																																																																																																			
						1.7	43.3	50.3	1.0					3.7																																																																																																		
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						0.7	33.6	58.9	3.4				0.7	2.7																																																																																																		
					9.5	65.4	23.4	0.6					1.0																																																																																																			
Ground Turkey (300)	1.0	3.7	[1.8 - 6.5]	<table border="1"> <tr> <td colspan="5"></td><td>1.7</td><td>43.3</td><td>50.3</td><td>1.0</td><td></td><td></td><td></td><td></td><td>3.7</td><td colspan="5"></td> </tr> </table>																			1.7	43.3	50.3	1.0					3.7																																																																																	
					1.7	43.3	50.3	1.0					3.7																																																																																																			
Ground Beef (250)	1.6	0.8	[0.1 - 2.9]	<table border="1"> <tr> <td colspan="5"></td><td>2.8</td><td>32.4</td><td>62.4</td><td>1.6</td><td></td><td></td><td></td><td></td><td>0.8</td><td colspan="5"></td> </tr> </table>																			2.8	32.4	62.4	1.6					0.8																																																																																	
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Pork Chops (146)	3.4	3.4	[1.1 - 7.8]	<table border="1"> <tr> <td colspan="5"></td><td>0.7</td><td>33.6</td><td>58.9</td><td>3.4</td><td></td><td></td><td></td><td>0.7</td><td>2.7</td><td colspan="5"></td> </tr> </table>																			0.7	33.6	58.9	3.4				0.7	2.7																																																																																	
					0.7	33.6	58.9	3.4				0.7	2.7																																																																																																			
Chickens (986)	0.6	1.0	[0.5 - 1.9]	<table border="1"> <tr> <td colspan="5"></td><td>9.5</td><td>65.4</td><td>23.4</td><td>0.6</td><td></td><td></td><td></td><td></td><td>1.0</td><td colspan="5"></td> </tr> </table>																			9.5	65.4	23.4	0.6					1.0																																																																																	
					9.5	65.4	23.4	0.6					1.0																																																																																																			

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates that were resistant

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

⁴ 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 areas 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

⁵ Breakpoints for ceftriaxone were revised to reflect those published in CLSI document M100-S20

Table 62c. Distribution of MICs and Occurrence of Resistance among *E. coli* Isolates from Retail Meats and Chickens, 2008

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	Chicken Breasts (306)	0.0	0.0	[0.0 - 1.2]	93.8	2.9		0.3	2.6	0.3											
	Ground Turkey (300)	0.0	0.0	[0.0 - 1.2]	92.7	3.3		0.3	3.7												
	Ground Beef (250)	0.0	0.0	[0.0 - 1.5]	97.6	2.0			0.4												
	Pork Chops (146)	0.0	0.0	[0.0 - 2.5]	97.3	2.7															
	Chickens (986)	0.0	0.6	[0.2 - 1.3]	92.9	1.1	0.2	2.3	2.8						0.1	0.5					
Nalidixic Acid																					
Nalidixic Acid	Chicken Breasts (306)	N/A	2.9	[1.4 - 5.5]						1.0	13.1	70.3	12.4	0.3			0.3	2.6			
	Ground Turkey (300)	N/A	3.7	[1.8 - 6.5]							7.0	74.7	14.7					3.7			
	Ground Beef (250)	N/A	0.4	[0.0 - 2.2]						0.8	3.2	83.6	12.0					0.4			
	Pork Chops (146)	N/A	0.0	[0.0 - 2.5]							8.9	72.6	16.4	2.1							
	Chickens (986)	N/A	6.0	[4.6 - 7.7]						1.3	26.0	62.3	4.2	0.2	0.1		0.9	5.1			
Tetracyclines																					
Tetracycline	Chicken Breasts (306)	0.7	43.8	[38.2 - 49.6]											55.6	0.7	1.0	2.3	40.5		
	Ground Turkey (300)	0.3	85.7	[81.2 - 89.4]											14.0	0.3	1.0	84.7			
	Ground Beef (250)	3.2	24.0	[18.8 - 29.8]											72.8	3.2	0.8	2.8	20.4		
	Pork Chops (146)	1.4	54.8	[46.4 - 63.0]											43.8	1.4	1.4	3.4	50.0		
	Chickens (986)	1.3	47.4	[44.2 - 50.5]											51.3	1.3	3.3	15.1	28.9		

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates that were resistant

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

⁴ 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 areas 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

Resistance by Year

Table 63a. Antimicrobial Resistance among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2008

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Chicken Breasts			282	396	400	393	418	299	306	
	Ground Turkey			304	333	376	396	388	315	300	
	Ground Beef			295	311	338	316	295	256	250	
	Pork Chops			184	218	232	205	182	152	146	
	Chickens	285	1989	2100	1365	1697	2232	1357	1510	986	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source									
Aminoglycosides	Amikacin (MIC ≥ 64 µg/ml)	Chicken Breasts			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Beef			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Pork Chops			0.0% 0	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	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Gentamicin (MIC ≥ 16 µg/ml)	Chicken Breasts			23.1% 65	29.3% 116	30.0% 120	37.7% 148	37.3% 156	34.4% 103	34.0% 104
		Ground Turkey			27.0% 82	29.7% 99	29.3% 110	27.5% 109	29.6% 115	27.0% 85	37.0% 111
		Ground Beef			0.3% 1	1.0% 3	0.6% 2	0.0% 0	4.1% 12	0.0% 0	2.0% 5
		Pork Chops			1.1% 2	1.4% 3	1.3% 3	0.0% 0	1.1% 2	1.3% 2	1.4% 2
		Chickens	40.0% 114	33.4% 664	38.0% 799	38.8% 530	39.1% 663	36.7% 819	33.1% 449	38.0% 574	44.5% 439
	Kanamycin (MIC ≥ 64 µg/ml)	Chicken Breasts			6.0% 17	6.8% 27	6.8% 27	7.1% 28	11.5% 48	9.0% 27	6.9% 21
		Ground Turkey			13.2% 40	16.8% 56	16.0% 60	11.4% 45	14.7% 57	15.6% 49	19.0% 57
		Ground Beef			2.4% 7	2.9% 9	2.4% 8	0.6% 2	4.7% 14	1.6% 4	4.0% 10
		Pork Chops			5.4% 10	8.7% 19	8.2% 19	7.3% 15	6.0% 11	4.6% 7	6.2% 9
		Chickens	16.1% 46	14.5% 288	11.6% 243	10.3% 140	11.5% 196	10.3% 231	9.1% 123	7.7% 117	10.2% 101
	Streptomycin (MIC ≥ 64 µg/ml)	Chicken Breasts			49.3% 139	56.1% 222	56.8% 227	50.6% 199	48.1% 201	46.8% 140	43.8% 134
		Ground Turkey			57.6% 175	54.7% 182	49.2% 185	43.4% 172	43.8% 170	44.8% 141	57.3% 172
		Ground Beef			9.5% 28	9.0% 28	11.8% 40	5.4% 17	14.2% 42	6.3% 16	10.4% 26
		Pork Chops			22.3% 41	19.7% 43	21.1% 49	13.2% 27	13.7% 25	13.8% 21	19.9% 29
		Chickens	77.5% 221	65.8% 1308	65.1% 1368	64.2% 877	64.1% 1088	58.0% 1295	49.5% 672	47.0% 710	54.6% 538
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	12.2% 48	11.5% 48	7.4% 22	11.8% 36
		Ground Turkey			5.6% 17	3.0% 10	5.3% 20	3.8% 15	6.7% 26	6.3% 20	8.3% 25
		Ground Beef			2.0% 6	2.3% 7	3.9% 13	1.3% 4	2.4% 7	0.8% 2	2.4% 6
		Pork Chops			5.4% 10	5.1% 11	5.6% 13	2.9% 6	2.2% 4	0.7% 1	3.4% 5
		Chickens	8.1% 23	10.0% 199	10.9% 229	11.1% 151	8.8% 149	10.6% 236	16.0% 217	11.2% 169	13.7% 135
Cephems	Cefoxitin (MIC ≥ 32 µg/ml)	Chicken Breasts			11.0% 31	9.3% 37	8.3% 33	11.2% 44	11.2% 47	7.4% 22	11.8% 36
		Ground Turkey			3.3% 10	1.2% 4	4.5% 17	3.3% 13	6.2% 24	6.3% 20	6.3% 19
		Ground Beef			1.4% 4	0.3% 1	1.2% 4	1.0% 3	2.0% 6	0.8% 2	2.4% 6
		Pork Chops			3.3% 6	2.3% 5	2.2% 5	1.5% 3	1.6% 3	0.7% 1	3.4% 5
		Chickens	7.4% 21	8.7% 173	8.5% 178	8.3% 113	8.2% 139	9.9% 221	15.0% 204	10.3% 155	13.8% 136

Table 63b. Antimicrobial Resistance among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2008

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Chicken Breasts			282	396	400	393	418	299	306	
	Ground Turkey			304	333	376	396	388	315	300	
	Ground Beef			295	311	338	316	295	256	250	
	Pork Chops			184	218	232	205	182	152	146	
	Chickens	285	1989	2100	1365	1697	2232	1357	1510	986	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source									
Cephems	Ceftriaxone (MIC ≥ 8 µg/ml)	Chicken Breasts			7.1% 20	7.6% 30	5.8% 23	8.7% 34	8.6% 36	6.0% 18	10.8% 33
		Ground Turkey			1.0% 3	0.3% 1	1.1% 4	1.8% 7	3.1% 12	6.0% 19	3.7% 11
		Ground Beef			0.0% 0	0.3% 1	0.9% 3	0.6% 2	1.0% 3	0.8% 2	1.6% 4
		Pork Chops			0.5% 1	0.9% 2	0.4% 1	0.0% 0	0.0% 0	0.7% 1	3.4% 5
		Chickens	6.3% 18	4.4% 88	5.5% 115	7.1% 97	4.9% 83	6.5% 145	10.2% 139	7.0% 106	10.5% 103
	Ceftriaxone (MIC ≥ 4 µg/ml) ¹	Chicken Breasts			7.8% 22	9.1% 36	6.5% 26	10.2% 40	9.1% 38	6.4% 19	11.1% 34
		Ground Turkey			1.3% 4	0.3% 1	1.3% 5	2.3% 9	3.1% 12	6.0% 19	3.7% 11
		Ground Beef			0.0% 0	0.3% 1	1.5% 5	1.9% 6	1.7% 5	0.8% 2	1.6% 4
		Pork Chops			0.5% 1	0.9% 2	0.4% 1	0.5% 1	0.6% 1	0.7% 1	3.4% 5
		Chickens	6.3% 18	7.6% 152	8.6% 181	9.4% 128	7.2% 122	9.0% 200	14.7% 199	10.3% 155	13.5% 133
Folate Pathway Inhibitors	Sulfamethoxazole/Sulfisoxazole ² (MIC ≥ 512 µg/ml)	Chicken Breasts			32.3% 91	38.4% 152	41.3% 165	48.1% 189	46.9% 196	42.1% 126	39.2% 120
		Ground Turkey			48.0% 146	51.7% 172	48.4% 182	48.0% 190	48.5% 188	48.9% 154	51.0% 153
		Ground Beef			9.8% 29	10.3% 32	13.0% 44	7.0% 22	12.5% 37	9.4% 24	11.6% 29
		Pork Chops			12.5% 23	15.1% 33	19.4% 45	14.1% 29	20.3% 37	11.8% 18	16.4% 24
		Chickens	57.9% 165	58.2% 1157	46.1% 969	43.9% 599	53.2% 903	51.9% 1159	48.6% 660	53.2% 804	52.7% 520
	Trimethoprim-Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Chicken Breasts			3.5% 10	7.1% 28	4.3% 17	7.4% 29	8.9% 37	5.0% 15	3.6% 11
		Ground Turkey			4.0% 12	6.9% 23	3.7% 14	5.1% 20	8.0% 31	7.9% 25	5.3% 16
		Ground Beef			0.7% 2	0.3% 1	0.6% 2	0.6% 2	1.4% 4	1.2% 3	2.0% 5
		Pork Chops			1.1% 2	2.8% 6	3.9% 9	1.5% 3	2.2% 4	1.3% 2	6.2% 9
		Chickens	17.2% 49	12.6% 251	10.4% 218	10.5% 144	10.7% 181	10.4% 232	8.4% 114	7.9% 120	9.1% 90
Penicillins	Ampicillin (MIC ≥ 32 µg/ml)	Chicken Breasts			21.6% 61	25.3% 100	17.0% 68	24.7% 97	20.1% 84	18.1% 54	23.5% 72
		Ground Turkey			31.3% 95	35.7% 119	33.2% 125	38.1% 151	42.0% 163	48.3% 152	58.0% 174
		Ground Beef			6.1% 18	5.1% 16	5.3% 18	3.5% 11	9.2% 27	6.6% 17	6.4% 16
		Pork Chops			13.6% 25	13.3% 29	15.1% 35	16.1% 33	15.9% 29	15.8% 24	15.1% 22
		Chickens	20.0% 57	19.5% 388	19.0% 399	18.6% 254	17.6% 298	22.0% 492	25.6% 347	18.7% 282	23.5% 232
Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)	Chicken Breasts			0.7% 2	0.0% 0	1.8% 7	0.5% 2	2.6% 11	2.0% 6	1.0% 3
		Ground Turkey			0.3% 1	3.6% 12	0.8% 3	4.0% 16	2.3% 9	2.9% 9	3.7% 11
		Ground Beef			1.0% 3	2.3% 7	3.6% 12	1.6% 5	1.4% 4	3.9% 10	0.8% 2
		Pork Chops			1.6% 3	4.1% 9	4.3% 10	3.4% 7	6.6% 12	3.9% 6	3.4% 5
		Chickens	4.6% 13	2.4% 47	1.8% 38	1.3% 18	1.0% 17	1.0% 22	1.9% 26	2.3% 34	1.0% 10

¹ Breakpoints for ceftriaxone were revised to reflect those published in CLSI document M100-S20

² Sulfamethoxazole was tested from 1996 through 2003 and was replaced by sulfisoxazole in 2004

Table 63c. Antimicrobial Resistance among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2008

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008	
Number of Isolates Tested	Chicken Breasts			282	396	400	393	418	299	306	
	Ground Turkey			304	333	376	396	388	315	300	
	Ground Beef			295	311	338	316	295	256	250	
	Pork Chops			184	218	232	205	182	152	146	
	Chickens	285	1989	2100	1365	1697	2232	1357	1510	986	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source									
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Chicken Breasts			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey			0.0% 0	0.3% 1	0.8% 3	0.0% 0	0.5% 2	0.3% 1	0.0% 0
		Ground Beef			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Pork Chops			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chickens	0.0% 0	0.2% 3	0.0% 0	0.1% 1	0.2% 3	0.4% 8	0.0% 0	0.1% 1	0.6% 6
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Chicken Breasts			2.8% 8	4.0% 16	7.0% 28	6.6% 26	5.0% 21	3.0% 9	2.9% 9
		Ground Turkey			4.3% 13	11.7% 39	10.6% 40	10.4% 41	5.2% 20	2.2% 7	3.7% 11
		Ground Beef			0.0% 0	1.0% 3	1.5% 5	1.3% 4	0.7% 2	0.4% 1	0.4% 1
		Pork Chops			0.5% 1	0.5% 1	0.0% 0	1.5% 3	0.5% 1	0.0% 0	0.0% 0
		Chickens	10.2% 29	8.4% 168	6.8% 142	6.2% 84	6.8% 115	7.5% 168	5.4% 73	4.2% 64	6.0% 59
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Chicken Breasts			46.1% 130	42.9% 170	48.0% 192	46.6% 183	50.5% 211	40.5% 121	43.8% 134
		Ground Turkey			77.0% 234	77.8% 259	74.2% 279	78.0% 309	76.5% 297	80.0% 252	85.7% 257
		Ground Beef			30.8% 91	25.1% 78	22.8% 77	16.5% 52	25.4% 75	21.9% 56	24.0% 60
		Pork Chops			52.7% 97	46.3% 101	56.0% 130	45.9% 94	52.7% 96	50.0% 76	54.8% 80
		Chickens	68.4% 195	61.6% 1226	58.6% 1231	52.2% 713	50.3% 853	48.9% 1092	49.0% 665	40.2% 607	47.4% 467

Multidrug Resistance

Table 64a. Resistance Patterns among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2008

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Chicken Breasts			282	396	400	393	418	299	306
	Ground Turkey			304	333	376	396	388	315	300
	Ground Beef			295	311	338	316	295	256	250
	Pork Chops			184	218	232	205	182	152	146
	Chickens	285	1989	2100	1365	1697	2232	1357	1510	986
Resistance Pattern	Isolate Source									
1. No Resistance Detected	Chicken Breasts			27.0% 76	20.5% 81	20.8% 83	20.6% 81	23.7% 99	29.1% 87	33.3% 102
	Ground Turkey			16.8% 51	14.7% 49	19.1% 72	16.2% 64	16.0% 62	13.0% 41	8.3% 25
	Ground Beef			63.1% 186	66.9% 208	73.1% 247	80.4% 254	71.5% 211	77.0% 197	73.2% 183
	Pork Chops			41.3% 76	44.5% 97	37.9% 88	48.8% 100	42.9% 78	48.0% 73	43.8% 64
	Chickens	10.2% 29	12.9% 257	15.9% 333	16.0% 219	17.0% 288	17.7% 395	18.6% 252	24.3% 367	20.9% 206
2. Resistant to ≥ 3 Antimicrobial Classes	Chicken Breasts			36.2% 102	42.2% 167	35.3% 141	45.0% 177	43.3% 181	33.8% 101	36.6% 112
	Ground Turkey			55.6% 169	55.6% 185	51.9% 195	52.6% 209	55.2% 214	57.5% 181	63.7% 191
	Ground Beef			10.2% 30	7.4% 23	10.4% 35	5.4% 17	11.5% 34	9.0% 23	11.2% 28
	Pork Chops			17.4% 32	17.9% 39	21.1% 49	16.1% 33	15.9% 29	15.1% 23	17.8% 26
	Chickens	55.1% 157	50.3% 1000	43.9% 921	39.2% 535	43.0% 729	41.5% 926	43.7% 593	36.7% 554	44.1% 435
3. Resistant to ≥ 4 Antimicrobial Classes	Chicken Breasts			13.8% 39	13.6% 54	12.5% 50	12.2% 48	14.6% 61	10.4% 31	13.7% 42
	Ground Turkey			23.0% 70	30.0% 100	24.5% 92	24.2% 96	25.8% 100	27.0% 85	32.3% 97
	Ground Beef			1.7% 5	4.2% 13	4.7% 16	1.9% 6	5.8% 17	4.7% 12	4.4% 11
	Pork Chops			5.4% 10	6.9% 15	7.8% 18	4.9% 10	7.7% 14	3.3% 5	7.5% 11
	Chickens	19.3% 55	16.1% 320	14.3% 300	13.8% 188	11.8% 200	14.9% 333	17.5% 137	13.6% 206	16.6% 164
4. Resistant to ≥ 5 Antimicrobial Classes	Chicken Breasts			6.0% 17	7.3% 29	6.0% 24	5.9% 23	7.4% 31	5.7% 17	7.8% 24
	Ground Turkey			9.2% 28	14.7% 49	6.9% 26	6.3% 25	5.7% 22	4.1% 13	6.3% 19
	Ground Beef			0.3% 1	2.6% 8	2.7% 9	1.0% 3	2.4% 7	0.4% 1	2.0% 5
	Pork Chops			3.3% 6	2.8% 6	2.2% 5	1.5% 3	3.3% 6	1.3% 2	4.1% 6
	Chickens	8.1% 23	8.1% 162	7.4% 155	7.2% 98	5.8% 98	7.6% 170	8.9% 121	7.1% 107	9.0% 89
5. At Least ACSSuT¹ Resistant	Chicken Breasts			0.4% 1	0.0% 0	1.3% 5	0.3% 1	1.4% 6	2.0% 6	1.0% 3
	Ground Turkey			0.0% 0	2.7% 9	0.5% 2	1.8% 7	0.8% 3	1.9% 6	2.0% 6
	Ground Beef			0.3% 1	1.0% 3	1.5% 5	0.6% 2	0.3% 1	0.4% 1	0.0% 0
	Pork Chops			0.5% 1	1.4% 3	1.3% 3	1.0% 2	1.1% 2	0.7% 1	1.4% 2
	Chickens	3.5% 10	2.0% 40	1.3% 27	1.0% 14	0.8% 14	0.6% 14	1.3% 18	1.7% 26	0.5% 5

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

Table 64b. Resistance Patterns among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2008

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008
Number of Isolates Tested	Chicken Breasts			282	396	400	393	418	299	306
	Ground Turkey			304	333	376	396	388	315	300
	Ground Beef			295	311	338	316	295	256	250
	Pork Chops			184	218	232	205	182	152	146
	Chickens	285	1989	2100	1365	1697	2232	1357	1510	986
Resistance Pattern	Isolate Source									
6. At Least ACT/S¹ Resistant	Chicken Breasts			0.0% 0	0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.3% 1	0.0% 0
	Ground Turkey			0.0% 0	0.9% 3	0.0% 0	0.8% 3	0.3% 1	0.3% 1	0.0% 0
	Ground Beef			0.0% 0	0.0% 0	0.0% 0	0.3% 1	0.3% 1	0.0% 0	0.0% 0
	Pork Chops			0.5% 1	0.0% 0	0.4% 1	0.5% 1	0.0% 0	0.0% 0	0.0% 0
	Chickens	1.4% 4	0.6% 11	0.3% 7	0.2% 3	0.3% 5	0.3% 7	0.2% 3	0.3% 4	0.3% 3
7. At Least ACSSuTAuCf² Resistant	Chicken Breasts			0.4% 1	0.0% 0	1.0% 4	0.3% 1	1.0% 4	0.7% 2	0.7% 2
	Ground Turkey			0.0% 0	0.3% 1	0.0% 0	0.3% 1	0.0% 0	1.3% 4	1.3% 4
	Ground Beef			0.0% 0	0.0% 0	0.9% 3	0.3% 1	0.0% 0	0.0% 0	0.0% 0
	Pork Chops			0.0% 0	0.5% 1	0.4% 1	0.0% 0	0.0% 0	0.7% 1	0.7% 1
	Chickens	2.8% 8	1.1% 22	0.8% 17	0.8% 11	0.6% 10	0.5% 11	1.0% 13	0.9% 14	0.4% 4
8. At Least Ceftiofur and Nalidixic Acid Resistant	Chicken Breasts			0.4% 1	0.5% 2	0.8% 3	0.3% 1	0.2% 1	0.0% 0	1.0% 3
	Ground Turkey			0.3% 1	0.3% 1	0.3% 1	0.0% 0	0.0% 0	0.6% 2	0.0% 0
	Ground Beef			0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.3% 1	0.0% 0	0.0% 0
	Pork Chops			0.5% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Chickens	1.4% 4	0.3% 5	0.4% 9	0.9% 12	0.4% 7	0.7% 16	0.4% 5	0.6% 9	0.4% 4

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

²ACSSuTAuCf = ACSSuT, amoxicillin-clavulanic acid, and ceftiofur

Appendix A

Table A1. Concentration Ranges Used for Susceptibility Testing of *Salmonella* and *E. coli*, 2008

Antimicrobial Class	Antimicrobial Agent	Concentration Range (µg/ml)
Aminoglycosides	Amikacin	0.5 - 64
	Gentamicin	0.25 - 16
	Kanamycin	8 - 64
	Streptomycin	32 - 64
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin–Clavulanic Acid	1 / 0.5 - 32 / 16
Cephems	Cefoxitin	0.5 - 32
	Ceftiofur	0.12 - 8
	Ceftriaxone	0.25 - 64
Folate Pathway Inhibitors	Sulfisoxazole	16 - 256
	Trimethoprim–Sulfamethoxazole	0.12 / 2.4 - 4 / 76
Penicillins	Ampicillin	1 - 32
Phenicol	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 of *Campylobacter*, 2008

Antimicrobial Class	Antimicrobial Agent	Concentration Range (µg/ml)
Aminoglycosides	Gentamicin	0.12 - 32
Ketolides	Telithromycin	0.015 - 8
Lincosamides	Clindamycin	0.03 - 16
Macrolides	Azithromycin	0.015 - 64
	Erythromycin	0.03 - 64
Phenicols	Florfenicol	0.03 - 64
Quinolones	Ciprofloxacin	0.015 - 64
	Nalidixic acid	4 - 64
Tetracyclines	Tetracycline	0.06 - 64

Appendix B

Table B1. Antimicrobial Agents and Antimicrobial Susceptibility Testing Methods for *Salmonella* and *E. coli* Isolates, 1996-2008 ^{1,2}

Antimicrobial Class	Method	Broth Microdilution													
	Sensititre® Plate Name	CMV1CCDC ³	CMV3CNCD			CMV4CNCD	CMV5CNCD	CMV6CNCD	CMV7CNCD		CMV1AGNF				
		CMV3CNCD	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Antimicrobial Agent															
Aminocyclitols	Apramycin	√	√	√	√	√	√								
Aminoglycosides	Amikacin	√	√	√	√	√	√	√	√	√	√	√	√	√	
	Gentamicin	√	√	√	√	√	√	√	√	√	√	√	√	√	
	Kanamycin	√	√	√	√	√	√	√	√	√	√	√	√	√	
	Streptomycin	√	√	√	√	√	√	√	√	√	√	√	√	√	
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin–Clavulanic Acid	√	√	√	√	√	√	√	√	√	√	√	√	√	
Cephems	Cefoxitin						√	√	√	√	√	√	√	√	
	Ceftiofur	√	√	√	√	√	√	√	√	√	√	√	√	√	
	Ceftriaxone	√	√	√	√	√	√	√	√	√	√	√	√	√	
	Cephalothin	√	√	√	√	√	√	√	√						
Coumarins	Novobiocin	√													
Folate Pathway Inhibitors	Sulfamethoxazole	√	√	√	√	√	√	√	√						
	Sulfisoxazole									√	√	√	√	√	
	Trimethoprim–Sulfamethoxazole	√	√	√	√	√	√	√	√	√	√	√	√	√	
Penems	Imipenem						√								
Penicillins	Ampicillin	√	√	√	√	√	√	√	√	√	√	√	√	√	
	Ticarcillin	√	√	√											
Phenicol	Chloramphenicol	√	√	√	√	√	√	√	√	√	√	√	√	√	
	Florfenicol				√										
Quinolones	Ciprofloxacin	√	√	√	√	√	√	√	√	√	√	√	√	√	
	Nalidixic acid	√	√	√	√	√	√	√	√	√	√	√	√	√	
Tetracyclines	Tetracycline	√	√	√	√	√	√	√	√	√	√	√	√	√	

¹ Testing of *Salmonella* isolates from humans, food animals, and retail meats began in 1996, 1997, and 2002, respectively

² Testing of *E. coli* isolates from chickens and retail meats began in 2000 and 2002, respectively. Testing of *E. coli* O157 isolates from humans began in 1996. A study of *E. coli* isolates from humans in the community began in 2004

³ In 1996, most isolates were tested using Sensititre® plate CMV1CCDC, but a few isolates were tested using Sensititre® plate CMV3CNCD

Table B2. Antimicrobial Agents and Antimicrobial Susceptibility Testing Methods for *Campylobacter* Isolates from Humans and Chickens, 1997-2008 ¹

Antimicrobial Class	Method	E-Test [®]									Broth Microdilution Sensititre [®] Plate: CAMPY			
	Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Antimicrobial Class	Antimicrobial Agent													
Aminoglycosides	Gentamicin		√	√	√	√	√	√	√	√	√	√	√	
Ketolides	Telithromycin									√	√	√	√	
Lincosamides	Clindamycin	√	√	√	√	√	√	√	√	√	√	√	√	
Macrolides	Azithromycin		√	√	√	√	√	√	√	√	√	√	√	
	Erythromycin	√	√	√	√	√	√	√	√	√	√	√	√	
Penems	Meropenem													
Phenolics	Chloramphenicol	√	√	√	√	√	√	√	√					
	Florfenicol									√	√	√	√	
Quinolones	Ciprofloxacin	√	√	√	√	√	√	√	√	√	√	√	√	
	Nalidixic acid	√	√	√	√	√	√	√	√	√	√	√	√	
Tetracyclines	Doxycycline													
	Tetracycline	√	√	√	√	√	√	√	√	√	√	√	√	

¹ Testing of *Campylobacter* isolates from humans and chickens began in 1997 and 1998, respectively. For chickens, this report contains data on isolates recovered during the period of July 2001 through December 2007, when the new isolation method was used by USDA's Agricultural Research Service

Table B3. Antimicrobial Agents and Antimicrobial Susceptibility Testing Methods for *Campylobacter* Isolates from Retail Meats, 2002-2008

Antimicrobial Class	Method						Agar Dilution		Broth Microdilution Sensititre [®] Plate: CAMPY					
	Year						2002	2003	2004	2005	2006	2007	2008	
Antimicrobial Class	Antimicrobial Agent													
Aminoglycosides	Gentamicin						√	√	√	√	√	√	√	
Ketolides	Telithromycin								√	√	√	√	√	
Lincosamides	Clindamycin								√	√	√	√	√	
Macrolides	Azithromycin								√	√	√	√	√	
	Erythromycin						√	√	√	√	√	√	√	
Penems	Meropenem						√	√						
Phenolics	Chloramphenicol													
	Florfenicol								√	√	√	√	√	
Quinolones	Ciprofloxacin						√	√	√	√	√	√	√	
	Nalidixic acid								√	√	√	√	√	
Tetracyclines	Doxycycline						√	√						
	Tetracycline								√	√	√	√	√	