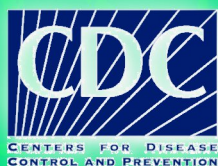


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2009

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 2009 from human clinical cases, retail meats and food animals at federally inspected slaughter and processing plants. In addition, the report includes susceptibility data for *Escherichia coli* recovered from retail meats and chicken carcasses in 2009. Summary data from prior years are also included.

Suggested Citation: FDA. National Antimicrobial Resistance Monitoring System – Enteric Bacteria (NARMS): 2009 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 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* serotype 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 sites. 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 from 2007-2009, 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 (Connecticut, Georgia, Maryland, Minnesota, New Mexico, Oregon, Tennessee, and selected counties in California, Colorado, and New York) by 2003. From 1997 to 2004, the first *Campylobacter* isolate received per week by a participating laboratory was submitted from each site to CDC. In 2005, FoodNet sites changed from submitting the first isolate received each week to submitting every isolate (Georgia, Maryland, New Mexico, Oregon, and Tennessee), every other isolate (California, Colorado, Connecticut, and New York), or every fifth isolate received (Minnesota).

2. Retail Meat Component

Retail meat sampling began in January 2002 with FoodNet sites in Connecticut, Georgia, Maryland, Minnesota, and Tennessee; Oregon joined in September. FoodNet sites in California and New York joined in 2003, and FoodNet sites 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 site tested the same sample sources for *Salmonella* only that year, but then began testing for *Campylobacter* also in 2009. Beginning in 2009, all 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 between 2007 and 2009 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 2009, 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 include *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 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.

⁴ CLSI. 2010. Performance Standards for Antimicrobial Susceptibility Testing; Twentieth Informational Supplement. CLSI document M100-S20. 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-A2, M100-S20, and M31-A3.^{3,4,5} For *Salmonella* and *E. coli*, CLSI breakpoints were available for all antimicrobial agents tested except streptomycin.^{4,5} For *Campylobacter*, CLSI breakpoints were available only for ciprofloxacin, doxycycline, erythromycin, and tetracycline.³ 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 $\mu\text{g/ml}$. NARMS began applying the new breakpoint in all 2008 reports.

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. Methods for Antimicrobial Dilution and Disk Susceptibility Testing of Infrequently Isolated or Fastidious Bacteria; Approved Guideline- Second Edition. CLSI document M45-A2. CLSI, Wayne, PA.

⁴ CLSI. 2010. Performance Standards for Antimicrobial Susceptibility Testing; Twentieth Informational Supplement. CLSI document M100-S20. CLSI, Wayne, PA.

⁵ 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	≤ 1	2	≥ 4
Folate Pathway Inhibitors	Sulfamethoxazole/Sulfisoxazole ²	≤ 256	N/A	≥ 512
	Trimethoprim–Sulfamethoxazole	≤ 2 / 38	N/A	≥ 4 / 76
Penicillins	Ampicillin	≤ 8	16	≥ 32
Phenicol	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 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 humans, retail meats and food animals at slaughter. 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, 2009 published by CDC.

Antimicrobial susceptibility data are first presented for all non-typhoidal *Salmonella enterica* serotypes. Data then presented the following top non-typhoidal *Salmonella enterica* serotypes in humans: Enteritidis, Typhimurium, Newport, Heidelberg, and I 4,[5],12:i:-. During 2009, Javiana was the fourth most common non-typhoidal *Salmonella* serotype in humans. However, those data are not presented separately in this report because no *Salmonella* ser. Javiana isolates were recovered from retail meats or food animals. *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 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 2009. 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.

The MIC distributions are followed by tables that show the numbers and percentages of isolates that were resistant, by year, from 1998 through 2009.³ Due to space constraints, data from years 1996 and 1997 are not shown in the resistance tables. Resistance data from 1996 and 1997 can be found in reports

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.

³ Data on *Campylobacter* recovered from chickens is presented only for the period of July 2001 through December 2009, as described in Section IIA.

prior to 2008.^{1,2} 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, Heidelberg, and I 4,[5],12;i:-.

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 6-16).^{3,4} Prior to 2008, 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.⁵

Finally, multidrug resistance data for all three genera are presented (Tables 13-29, 32, 35, 38, 41, 44, 52, 56, and 61). Data for specific multidrug resistance phenotypes of public health importance are reported along with data on resistance to CLSI antimicrobial classes. Tables 13-21 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. 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 2009 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 also in the 2009 report. All seven antimicrobial classes and all nine antimicrobial agents included in broth microdilution testing of *Campylobacter* isolates are represented in Tables 52 and 56.

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 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.

² Data from 1996 and 1997 are still included in the graphs and supporting tables.

³ Note that the scales vary from figure to figure, based on the maximum percent resistance.

⁴ 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.

⁵ 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, 1996-2009 ¹

Source	Year													
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	1318	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2380	2192
Chicken Breasts							60	83	157	153	152	99	199	277
Ground Turkey							74	114	142	183	159	190	245	190
Ground Beef							9	10	14	8	19	13	24	14
Pork Chops							10	5	11	9	8	18	23	8
Chickens		214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551
Turkeys		107	240	713	518	550	244	262	236	227	304	271	148	121
Cattle		24	284	1610	1388	893	1008	670	607	329	389	439	443	200
Swine		111	793	876	451	418	379	211	308	301	304	211	111	120

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*, 2009

	Chicken Breasts	Ground Turkey	Ground Beef	Pork Chops
Number of Meat Samples Tested	1320	1320	1320	1320
Number Positive for <i>Salmonella</i>	277	190	14	8
Percent Positive for <i>Salmonella</i>	21.0%	14.4%	1.1%	0.6%

Figure 1. Percent of Retail Meat Samples Culture Positive for *Salmonella*, 2009

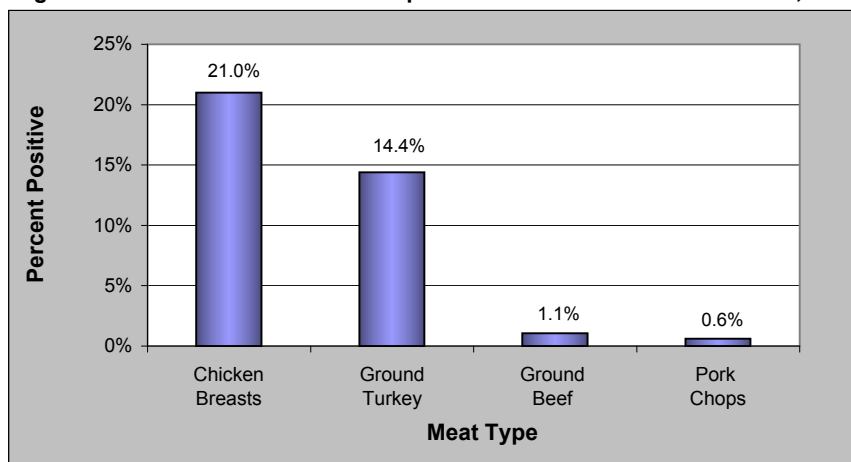
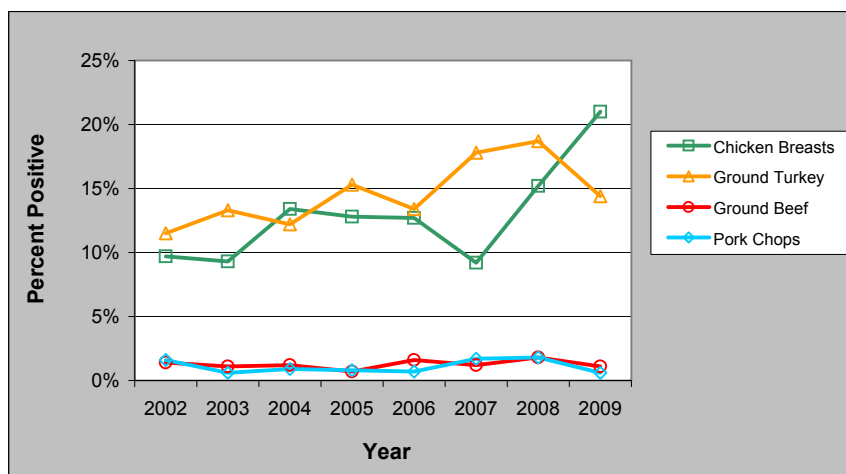


Figure 2. Percent of Retail Meat Samples Culture Positive for *Salmonella*, 2002-2009



C. Non-Typhoidal *Salmonella* Serotypes

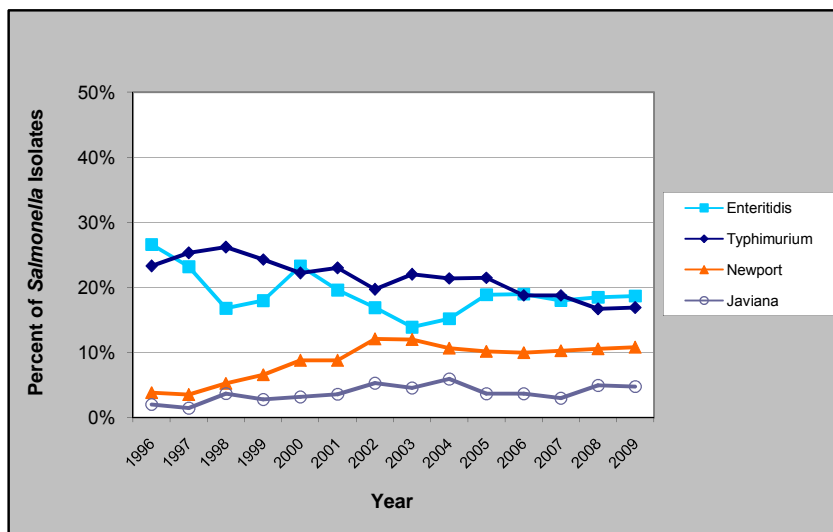
Table 5. Most Common Serotypes among Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, 2009

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (N=2192)	Enteritidis	410	18.7	Chicken Breasts (N=277)	Typhimurium	123	44.4	Chickens (N=551)	Kentucky	214	38.8
	Typhimurium	371	16.9		Heidelberg	45	16.2		Enteritidis	118	21.4
	Newport	236	10.8		Kentucky	44	15.9		Heidelberg	74	13.4
	Javiana	105	4.8		Enteritidis	27	9.7		Typhimurium	36	6.5
	Heidelberg	86	3.9		I 4,[5],12:i:-	8	2.9		I 4,[5],12:i:-	21	3.8
	I 4,[5],12:i:-	72	3.3		Mbandaka	4	1.4		I 8,20:-:z6	13	2.4
	Oranienburg	64	2.9		Montevideo	4	1.4		Montevideo	10	1.8
	Saintpaul	57	2.6		Braenderup	3	1.1		Schwarzengrund	8	1.5
	Montevideo	56	2.6		Hadar	3	1.1		Hadar	6	1.1
	Braenderup	46	2.1		Infantis	3	1.1		Senftenberg	6	1.1
	Infantis	44	2.0	I 9,12:nonmotile	2	0.7	Worthington	6	1.1		
	Muenchen	42	1.9	Senftenberg	2	0.7	Braenderup	4	0.7		
	Mississippi	28	1.3	Other	9	3.2	Other	35	6.4		
	Thompson	27	1.2								
	Agona	21	1.0	Ground Turkey (N=190)	Saintpaul	76	40.0	Turkeys (N=121)	Hadar	32	26.4
	Bareilly	20	0.9		Hadar	20	10.5		Saintpaul	18	14.9
	Litchfield	20	0.9		Illa 18:z4,z23:-	18	9.5		Agona	15	12.4
	Paratyphi B var. L(+) tartrate+	20	0.9		Heidelberg	10	5.3		Schwarzengrund	7	5.8
	Hadar	19	0.9		Senftenberg	10	5.3		Senftenberg	7	5.8
	Poona	16	0.7		I 4,12:d:-	9	4.7		Illa 18:z4,z23:-	6	5.0
All other serotypes	373	17.0	Schwarzengrund		9	4.7	Albany		5	4.1	
Unknown serotype	19	0.9	Albany		6	3.2	Derby		4	3.3	
Partially serotyped	20	0.9	Derby		5	2.6	Heidelberg		3	2.5	
Rough/Nonmotile isolates	20	0.9	I 4,5,12:r:-		4	2.1	Muenchen		3	2.5	
			Montevideo	4	2.1	Newport	3	2.5			
			Agona	3	1.6	Other	18	14.9			
			Berta	3	1.6						
			Newport	3	1.6						
			Kentucky	2	1.1						
			Other	8	4.2						
			Ground Beef (N=14)	Montevideo	4	28.6	Cattle (N=200)	Montevideo	59	29.5	
				Dublin	3	21.4		Dublin	21	10.5	
				Saintpaul	3	21.4		Typhimurium	18	9.0	
				Newport	2	14.3		Newport	17	8.5	
				Give	1	7.1		Kentucky	10	5.0	
				Muenster	1	7.1		Cerro	9	4.5	
						Meleagridis	8	4.0			
						Anatum	7	3.5			
						Muenchen	6	3.0			
						Agona	5	2.5			
						Muenster	4	2.0			
						Other	36	18.0			
			Pork Chops (N=8)	Derby	3	37.5	Swine (N=120)	Derby	24	20.0	
				Infantis	2	25.0		Typhimurium	20	16.7	
				Heidelberg	1	12.5		Johannesburg	11	9.2	
				Ohio	1	12.5		Anatum	10	8.3	
				Typhimurium	1	12.5		Infantis	10	8.3	
						Adelaide	5	4.2			
						Agona	4	3.3			
						Bredeney	4	3.3			
						Heidelberg	4	3.3			
						Saintpaul	4	3.3			
						Other	24	20.0			

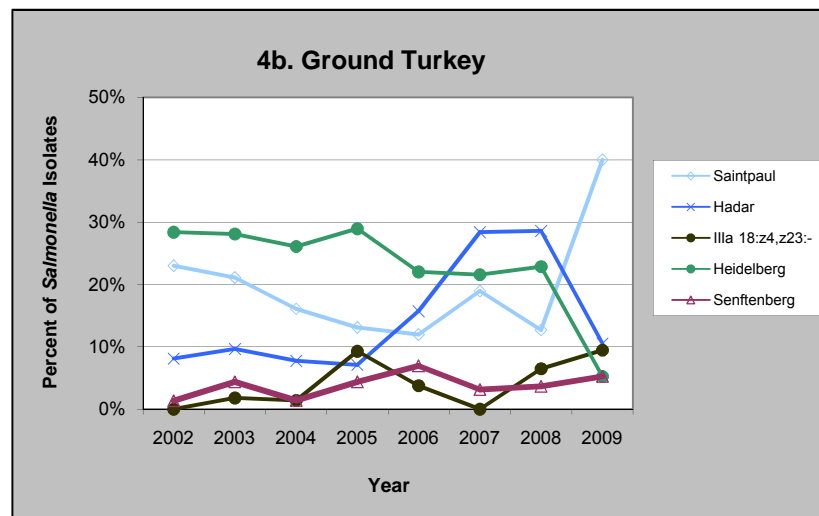
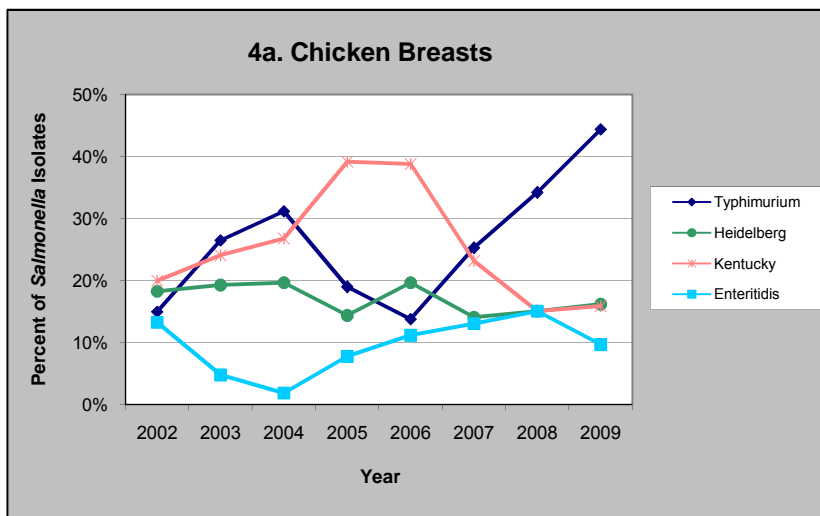
Table 6. Most Common Non-Typhoidal *Salmonella* Serotypes in Humans and their Distributions among Retail Meat and Food Animal Isolates, by Meat Type and Animal Source, 2009

	Humans	Retail Meats				Food Animals			
	Humans (N=2192)	Chicken Breast (N=277)	Ground Turkey (N=190)	Ground Beef (N=14)	Pork Chops (N=8)	Chickens (N=551)	Turkeys (N=121)	Cattle (N=200)	Swine (N=120)
1. Enteritidis	18.7% 410	9.7% 27	0.0% 0	0.0% 0	0.0% 0	21.4% 118	0.0% 0	0.0% 0	0.0% 0
2. Typhimurium	16.9% 371	44.4% 123	0.5% 1	0.0% 0	12.5% 1	6.5% 36	1.7% 2	9.0% 18	16.7% 20
3. Newport	10.8% 236	0.4% 1	1.6% 3	14.3% 2	0.0% 0	0.0% 0	2.5% 3	8.5% 17	0.0% 0
4. Javiana	4.8% 105	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
5. Heidelberg	3.9% 86	16.2% 45	5.3% 10	0.0% 0	12.5% 1	13.4% 74	2.5% 3	0.0% 0	3.3% 4
6. I 4,[5],12:i-	3.3% 72	2.9% 8	0.0% 0	0.0% 0	0.0% 0	3.8% 21	0.0% 0	0.5% 1	0.8% 1
7. Oranienburg	2.9% 64	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.5% 1	0.0% 0
8. Saintpaul	2.6% 57	0.4% 1	40.0% 76	21.4% 3	0.0% 0	0.0% 0	14.9% 18	0.0% 0	3.3% 4
9. Montevideo	2.6% 56	1.4% 4	2.1% 4	28.6% 4	0.0% 0	1.8% 10	0.8% 1	29.5% 59	1.7% 2
10. Braenderup	2.1% 46	1.1% 3	0.0% 0	0.0% 0	0.0% 0	0.7% 4	0.0% 0	0.0% 0	0.8% 1

Figure 3. Most Common Non-Typhoidal *Salmonella* Serotypes from Humans in 2009 and their Relative Frequencies, by Year, 1996-2009

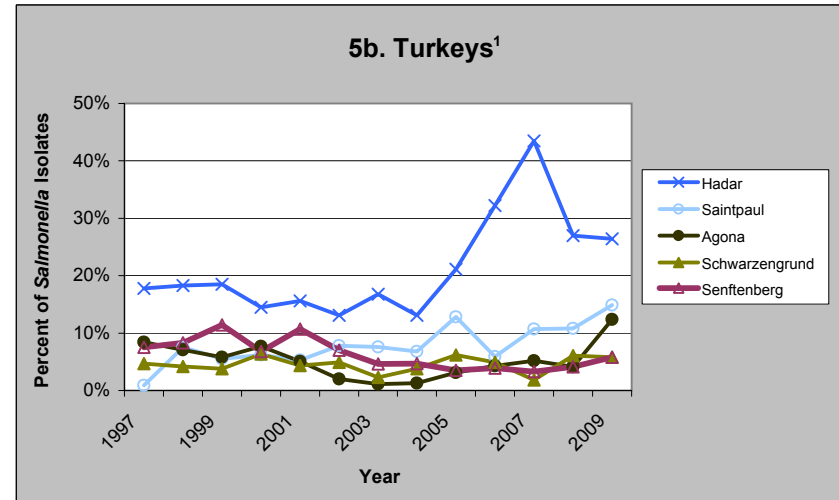
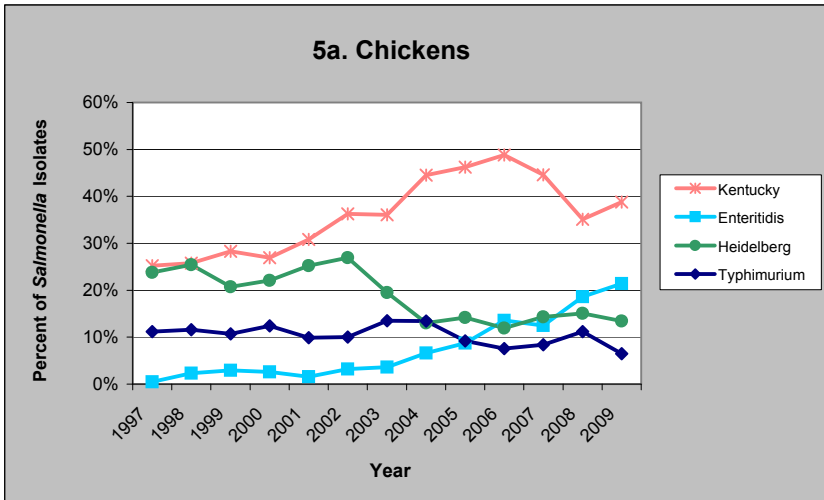


Figures 4a-b. Most Common Non-Typhoidal *Salmonella* Serotypes from Retail Poultry in 2009 and their Relative Frequencies, by Year, 2002-2009¹

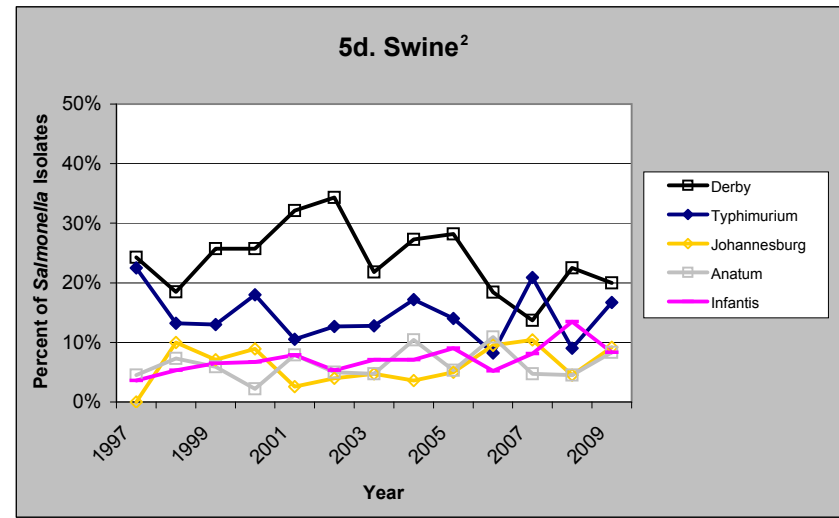
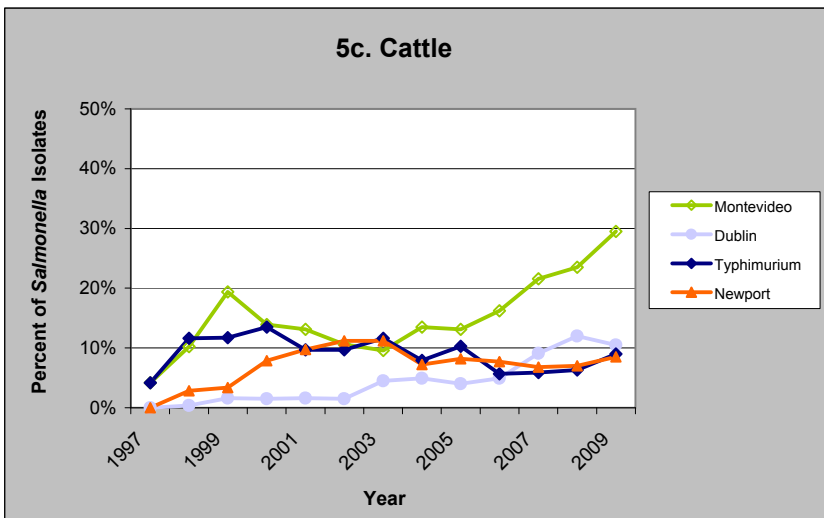


¹ Graphs are not provided for ground beef and pork chops due to the small number of *Salmonella* isolates from these sources

Figures 5a-d. Most Common Non-Typhoidal *Salmonella* Serotypes from Food Animals in 2009 and their Relative Frequencies, by Year, 1997-2009



¹ There are five serotypes shown because the fourth highest frequency was shared by two serotypes. See table 5



² There are five serotypes shown because the fourth highest frequency was shared by two 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, 2009

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
Aminoglycosides Amikacin	Humans (2192)	0.0	0.0	[0.0 - 0.2]							7.8	74.6	15.9	1.6	<0.1					
	Chicken Breasts (277)	0.0	0.0	[0.0 - 1.3]							8.3	48.0	39.4	4.3						
	Ground Turkey (190)	0.0	0.0	[0.0 - 1.9]							0.5	36.8	55.3	7.4						
	Ground Beef (14)	0.0	0.0	[0.0 - 23.2]								28.6	57.1	14.3						
	Pork Chops (8)	0.0	0.0	[0.0 - 36.9]									75.0	25.0						
	Chickens (551)	0.0	0.0	[0.0 - 0.7]							9.6	71.3	18.3	0.5	0.2					
	Turkeys (121)	0.0	0.0	[0.0 - 3.0]							5.8	58.7	31.4	4.1						
	Cattle (200)	0.0	0.0	[0.0 - 1.8]							2.0	47.0	48.5	2.5						
	Swine (120)	0.0	0.0	[0.0 - 3.0]							3.3	83.3	12.5	0.8						
Gentamicin	Humans (2192)	0.2	1.3	[0.9 - 1.8]	64.2	32.8	1.3	0.1		0.2	0.7	0.6								
	Chicken Breasts (277)	0.7	3.6	[1.7 - 6.5]	51.6	40.4	3.3		0.4	0.7	1.4	2.2								
	Ground Turkey (190)	1.6	18.4	[13.2 - 24.7]	25.8	46.3	6.8	0.5	0.5	1.6	2.6	15.8								
	Ground Beef (14)	0.0	14.3	[1.8 - 42.8]	7.1	57.1	14.3	7.1			7.1	7.1								
	Pork Chops (8)	0.0	0.0	[0.0 - 36.9]	12.5	75.0	12.5													
	Chickens (551)	0.9	5.6	[3.9 - 7.9]	70.4	22.1	0.7		0.2	0.9	2.5	3.1								
	Turkeys (121)	0.8	14.9	[9.1 - 22.5]	40.5	43.0			0.8	0.8	4.1	10.7								
	Cattle (200)	0.0	2.0	[0.5 - 5.0]	39.0	55.5	3.0	0.5												
	Swine (120)	0.8	0.0	[0.0 - 3.0]	66.7	30.8	0.8		0.8	0.8										
Kanamycin	Humans (2192)	<0.1	2.5	[1.9 - 3.2]								97.3	0.2	<0.1	<0.1	2.4				
	Chicken Breasts (277)	0.0	15.2	[11.2 - 19.9]								84.5	0.4			15.2				
	Ground Turkey (190)	0.0	6.8	[3.7 - 11.4]								91.6	1.6			6.8				
	Ground Beef (14)	0.0	14.3	[1.8 - 42.8]								85.7				14.3				
	Pork Chops (8)	0.0	12.5	[0.3 - 52.7]								87.5				12.5				
	Chickens (551)	0.2	3.1	[1.8 - 4.9]								96.4	0.4	0.2	0.7	2.4				
	Turkeys (121)	0.0	10.7	[5.8 - 17.7]								89.3				10.7				
	Cattle (200)	0.0	9.0	[5.4 - 13.9]								91.0				9.0				
	Swine (120)	0.0	4.2	[1.4 - 9.5]								95.0	0.8			4.2				
Streptomycin	Humans (2192)	N/A	8.9	[7.8 - 10.2]												91.1	4.2	4.8		
	Chicken Breasts (277)	N/A	23.1	[18.3 - 28.5]												76.9	15.9	7.2		
	Ground Turkey (190)	N/A	27.9	[21.6 - 34.8]												72.1	17.9	10.0		
	Ground Beef (14)	N/A	28.6	[8.4 - 58.1]												71.4		28.6		
	Pork Chops (8)	N/A	37.5	[8.5 - 75.5]												62.5		37.5		
	Chickens (551)	N/A	30.5	[26.7 - 34.5]												69.5	20.9	9.6		
	Turkeys (121)	N/A	38.8	[30.1 - 48.1]												61.2	23.1	15.7		
	Cattle (200)	N/A	22.0	[16.5 - 28.4]												78.0	5.5	16.5		
	Swine (120)	N/A	29.2	[21.2 - 38.2]												70.8	10.8	18.3		

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates with resistance. Discrepancies between %R and sums of distribution %'s, to the right of the double vertical bars, are due to rounding

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, 2009

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 (2192)	3.6	3.4	[2.7 - 4.3]	<table border="1"> <tr> <td>87.5</td><td>2.5</td><td>0.4</td><td>2.6</td><td>3.6</td><td>0.8</td><td>2.6</td><td colspan="10"></td> </tr> <tr> <td>50.2</td><td>3.6</td><td>0.4</td><td>4.3</td><td>4.3</td><td>6.5</td><td>30.7</td><td colspan="10"></td> </tr> <tr> <td>37.9</td><td>4.2</td><td></td><td>33.7</td><td>18.4</td><td>2.1</td><td>3.7</td><td colspan="10"></td> </tr> <tr> <td>50.0</td><td>21.4</td><td></td><td></td><td>14.3</td><td></td><td>14.3</td><td colspan="10"></td> </tr> <tr> <td>62.5</td><td></td><td></td><td></td><td>12.5</td><td>12.5</td><td>12.5</td><td colspan="10"></td> </tr> <tr> <td>84.0</td><td>2.0</td><td>0.2</td><td>0.9</td><td></td><td>3.8</td><td>9.1</td><td colspan="10"></td> </tr> <tr> <td>60.3</td><td>0.8</td><td></td><td>7.4</td><td>18.2</td><td>3.3</td><td>9.9</td><td colspan="10"></td> </tr> <tr> <td>74.5</td><td>3.0</td><td>1.0</td><td>4.0</td><td>2.5</td><td>6.5</td><td>8.5</td><td colspan="10"></td> </tr> <tr> <td>78.3</td><td>2.5</td><td>2.5</td><td>1.7</td><td>10.8</td><td></td><td>4.2</td><td colspan="10"></td> </tr> </table>																87.5	2.5	0.4	2.6	3.6	0.8	2.6											50.2	3.6	0.4	4.3	4.3	6.5	30.7											37.9	4.2		33.7	18.4	2.1	3.7											50.0	21.4			14.3		14.3											62.5				12.5	12.5	12.5											84.0	2.0	0.2	0.9		3.8	9.1											60.3	0.8		7.4	18.2	3.3	9.9											74.5	3.0	1.0	4.0	2.5	6.5	8.5											78.3	2.5	2.5	1.7	10.8		4.2																	
	87.5	2.5	0.4	2.6																	3.6	0.8	2.6																																																																																																																																																													
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Cephems Cefoxitin	Humans (2192)	0.3	3.2	[2.5 - 4.1]	<table border="1"> <tr> <td>0.1</td><td>36.1</td><td>47.4</td><td>11.8</td><td>1.0</td><td>0.3</td><td>1.4</td><td>1.9</td><td colspan="10"></td> </tr> <tr> <td>0.7</td><td>43.0</td><td>16.2</td><td>2.5</td><td>5.1</td><td>16.2</td><td>16.2</td><td colspan="10"></td> </tr> <tr> <td>1.6</td><td>63.7</td><td>26.3</td><td>2.6</td><td></td><td>2.1</td><td>3.7</td><td colspan="10"></td> </tr> <tr> <td></td><td>57.1</td><td>14.3</td><td>14.3</td><td></td><td></td><td>14.3</td><td colspan="10"></td> </tr> <tr> <td></td><td>12.5</td><td>62.5</td><td></td><td></td><td>12.5</td><td>12.5</td><td colspan="10"></td> </tr> <tr> <td>25.2</td><td>50.8</td><td>10.7</td><td>0.5</td><td>1.3</td><td>9.3</td><td>2.2</td><td colspan="10"></td> </tr> <tr> <td>15.7</td><td>51.2</td><td>19.0</td><td>1.7</td><td></td><td>1.7</td><td>10.7</td><td colspan="10"></td> </tr> <tr> <td>18.5</td><td>36.0</td><td>27.0</td><td>3.0</td><td>2.0</td><td>5.5</td><td>8.0</td><td colspan="10"></td> </tr> <tr> <td>10.8</td><td>39.2</td><td>42.5</td><td>3.3</td><td></td><td>0.8</td><td>3.3</td><td colspan="10"></td> </tr> </table>																0.1	36.1	47.4	11.8	1.0	0.3	1.4	1.9											0.7	43.0	16.2	2.5	5.1	16.2	16.2											1.6	63.7	26.3	2.6		2.1	3.7												57.1	14.3	14.3			14.3												12.5	62.5			12.5	12.5											25.2	50.8	10.7	0.5	1.3	9.3	2.2											15.7	51.2	19.0	1.7		1.7	10.7											18.5	36.0	27.0	3.0	2.0	5.5	8.0											10.8	39.2	42.5	3.3		0.8	3.3																
	0.1	36.1	47.4	11.8																	1.0	0.3	1.4	1.9																																																																																																																																																												
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	18.5	36.0	27.0	3.0																	2.0	5.5	8.0																																																																																																																																																													
10.8	39.2	42.5	3.3		0.8	3.3																																																																																																																																																																														
Ceftiofur	Humans (2192)	<0.1	3.4	[2.7 - 4.3]	<table border="1"> <tr> <td>0.1</td><td>0.8</td><td>21.1</td><td>73.2</td><td>1.3</td><td><0.1</td><td>0.2</td><td>3.2</td><td colspan="10"></td> </tr> <tr> <td></td><td></td><td>14.1</td><td>46.9</td><td>1.8</td><td>0.4</td><td>10.1</td><td>26.7</td><td colspan="10"></td> </tr> <tr> <td></td><td>0.5</td><td>10.5</td><td>80.5</td><td>2.6</td><td></td><td>1.1</td><td>4.7</td><td colspan="10"></td> </tr> <tr> <td></td><td></td><td>14.3</td><td>71.4</td><td></td><td></td><td></td><td>14.3</td><td colspan="10"></td> </tr> <tr> <td></td><td></td><td>75.0</td><td></td><td></td><td></td><td></td><td>25.0</td><td colspan="10"></td> </tr> <tr> <td>0.2</td><td></td><td>47.5</td><td>39.0</td><td>0.4</td><td>0.2</td><td>0.7</td><td>12.0</td><td colspan="10"></td> </tr> <tr> <td></td><td></td><td>29.8</td><td>57.9</td><td></td><td></td><td>0.8</td><td>11.6</td><td colspan="10"></td> </tr> <tr> <td>2.0</td><td>37.5</td><td>43.5</td><td>2.0</td><td>0.5</td><td>1.0</td><td>13.5</td><td colspan="10"></td> </tr> <tr> <td>0.8</td><td>29.2</td><td>63.3</td><td>2.5</td><td></td><td></td><td>4.2</td><td colspan="10"></td> </tr> </table>																0.1	0.8	21.1	73.2	1.3	<0.1	0.2	3.2													14.1	46.9	1.8	0.4	10.1	26.7												0.5	10.5	80.5	2.6		1.1	4.7													14.3	71.4				14.3													75.0					25.0											0.2		47.5	39.0	0.4	0.2	0.7	12.0													29.8	57.9			0.8	11.6											2.0	37.5	43.5	2.0	0.5	1.0	13.5											0.8	29.2	63.3	2.5			4.2										
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Ceftriaxone	Humans (2192)	0.0	3.4	[2.7 - 4.3]	<table border="1"> <tr> <td>96.5</td><td><0.1</td><td></td><td></td><td></td><td>0.2</td><td>0.7</td><td>1.4</td><td>0.6</td><td>0.4</td><td>0.2</td><td colspan="6"></td> </tr> <tr> <td>62.5</td><td></td><td></td><td></td><td></td><td>0.4</td><td>9.7</td><td>18.4</td><td>8.7</td><td>0.4</td><td colspan="6"></td> </tr> <tr> <td>94.2</td><td></td><td></td><td></td><td></td><td></td><td>0.5</td><td>2.6</td><td>2.1</td><td>0.5</td><td colspan="6"></td> </tr> <tr> <td>85.7</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>7.1</td><td>7.1</td><td colspan="6"></td> </tr> <tr> <td>75.0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>25.0</td><td></td><td colspan="6"></td> </tr> <tr> <td>86.9</td><td>0.2</td><td></td><td></td><td></td><td>0.9</td><td>3.4</td><td>6.5</td><td>1.5</td><td>0.4</td><td>0.2</td><td colspan="5"></td> </tr> <tr> <td>87.6</td><td></td><td></td><td></td><td></td><td></td><td>0.8</td><td>4.1</td><td>6.6</td><td>0.8</td><td colspan="6"></td> </tr> <tr> <td>85.0</td><td></td><td></td><td></td><td>0.5</td><td>1.0</td><td>1.0</td><td>9.0</td><td>3.5</td><td colspan="6"></td> </tr> <tr> <td>95.8</td><td></td><td></td><td></td><td></td><td></td><td>0.8</td><td>1.7</td><td>1.7</td><td colspan="6"></td> </tr> </table>																96.5	<0.1				0.2	0.7	1.4	0.6	0.4	0.2							62.5					0.4	9.7	18.4	8.7	0.4							94.2						0.5	2.6	2.1	0.5							85.7								7.1	7.1							75.0								25.0								86.9	0.2				0.9	3.4	6.5	1.5	0.4	0.2						87.6						0.8	4.1	6.6	0.8							85.0				0.5	1.0	1.0	9.0	3.5							95.8						0.8	1.7	1.7																							
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¹ Percent of isolates with intermediate susceptibility

² Percent of isolates with resistance. Discrepancies between %R and sums of distribution %'s, to the right of the double vertical bars, are due to rounding

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 7c. Distribution of MICs and Occurrence of Resistance among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, 2009

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
Folate Pathway Inhibitors Sulfisoxazole	Humans (2192)	N/A	9.9	[8.7 - 11.2]											5.0	35.2	47.0	2.8	0.1	9.9
	Chicken Breasts (277)	N/A	48.0	[42.0 - 54.1]											4.7	15.5	29.2	2.2	0.4	48.0
	Ground Turkey (190)	N/A	20.0	[14.6 - 26.4]											4.7	13.2	60.0	2.1		20.0
	Ground Beef (14)	N/A	35.7	[12.8 - 64.9]												7.1	57.1			35.7
	Pork Chops (8)	N/A	37.5	[8.5 - 75.5]												12.5	50.0			37.5
	Chickens (551)	N/A	10.0	[7.6 - 12.8]											27.2	50.8	11.6	0.4		10.0
	Turkeys (121)	N/A	28.9	[21.0 - 37.9]											14.9	41.3	13.2	1.7		28.9
	Cattle (200)	N/A	24.5	[18.7 - 31.1]											21.0	43.5	10.0	1.0		24.5
	Swine (120)	N/A	30.8	[22.7 - 39.9]											26.7	30.8	10.8		0.8	30.8
Trimethoprim-Sulfamethoxazole	Humans (2192)	N/A	1.7	[1.2 - 2.4]	95.8	2.2	0.2	<0.1												1.7
	Chicken Breasts (277)	N/A	0.4	[0.0 - 2.0]	97.8	1.4	0.4						0.4							
	Ground Turkey (190)	N/A	1.6	[0.3 - 4.5]	96.8	1.6														1.6
	Ground Beef (14)	N/A	0.0	[0.0 - 23.2]	71.4	28.6														
	Pork Chops (8)	N/A	25.0	[3.2 - 65.1]	75.0															25.0
	Chickens (551)	N/A	0.2	[0.0 - 1.0]	94.0	5.8														0.2
	Turkeys (121)	N/A	1.7	[0.2 - 5.8]	89.3	9.1														1.7
	Cattle (200)	N/A	1.5	[0.3 - 4.3]	80.5	15.0	2.0	1.0												1.5
	Swine (120)	N/A	2.5	[0.5 - 7.1]	73.3	23.3	0.8													2.5
Penicillins Ampicillin	Humans (2192)	<0.1	9.9	[8.6 - 11.2]							83.7	5.9	0.3	0.2	<0.1					9.9
	Chicken Breasts (277)	0.0	45.8	[39.9 - 51.9]							44.8	9.0	0.4							45.9
	Ground Turkey (190)	0.0	57.9	[50.5 - 65.0]							34.7	6.8	0.5							57.9
	Ground Beef (14)	0.0	28.6	[8.4 - 58.1]							42.9	28.6								28.6
	Pork Chops (8)	0.0	37.5	[8.5 - 75.5]							62.5									37.5
	Chickens (551)	0.0	13.8	[11.0 - 17.0]							81.5	4.4	0.4							13.8
	Turkeys (121)	0.0	38.8	[30.1 - 48.1]							57.9	2.5	0.8							38.8
	Cattle (200)	0.0	22.5	[16.9 - 28.9]							74.0	2.5	0.5	0.5						22.5
	Swine (120)	0.0	19.2	[12.6 - 27.4]							74.2	6.7								19.2
Phenicol Chloramphenicol	Humans (2192)	1.0	5.7	[4.8 - 6.8]							0.7	49.0	43.6	1.0	<0.1					5.6
	Chicken Breasts (277)	0.4	0.0	[0.0 - 1.3]								23.1	76.5	0.4						
	Ground Turkey (190)	1.1	1.6	[0.3 - 4.5]							1.1	22.6	73.7	1.1	1.1					0.5
	Ground Beef (14)	0.0	21.4	[4.7 - 50.8]								7.1	71.4							21.4
	Pork Chops (8)	12.5	12.5	[0.3 - 52.7]									75.0	12.5						12.5
	Chickens (551)	0.2	1.6	[0.7 - 3.1]							15.1	61.7	21.4	0.2	0.2					1.5
	Turkeys (121)	0.8	3.3	[0.9 - 8.2]							14.9	57.0	24.0	0.8						3.3
	Cattle (200)	1.0	21.0	[15.6 - 27.3]							3.1	49.0	26.0	1.0	0.5					20.5
	Swine (120)	1.7	15.0	[9.1 - 22.7]								20.8	62.5	1.7						15.0

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates with resistance. Discrepancies between %R and sums of distribution %'s, to the right of the double vertical bars, are due to rounding

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, 2009

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 (2192)	0.1	0.0	[0.0 - 0.3]	92.9	4.5	0.2	0.7	1.0	0.4	0.1	0.1	<0.1														
	Chicken Breasts (277)	0.0	0.0	[0.0 - 1.3]	78.0	20.6	1.1	0.4																			
	Ground Turkey (190)	0.0	0.0	[0.0 - 1.9]	84.7	14.7	0.5																				
	Ground Beef (14)	0.0	0.0	[0.0 - 23.2]	71.4	14.3	14.3																				
	Pork Chops (8)	0.0	0.0	[0.0 - 36.9]	62.5	37.5																					
	Chickens (551)	0.0	0.0	[0.0 - 0.7]	90.4	9.6																					
	Turkeys (121)	0.0	0.0	[0.0 - 3.0]	97.5	1.7	0.8																				
	Cattle (200)	0.0	0.0	[0.0 - 1.8]	95.5	3.0	0.5	0.5	0.5																		
Swine (120)	0.0	0.0	[0.0 - 3.0]	92.5	7.5																						
Nalidixic Acid																											
Nalidixic Acid	Humans (2192)	N/A	1.8	[1.3 - 2.4]								0.3	39.6	57.0	0.9	0.4	0.1	1.6									
	Chicken Breasts (277)	N/A	0.4	[0.0 - 2.0]								0.4	16.2	82.0	0.7	0.4			0.4								
	Ground Turkey (190)	N/A	0.0	[0.0 - 1.9]								0.5	15.8	81.1	2.6					14.3							
	Ground Beef (14)	N/A	14.3	[1.8 - 42.8]								21.4		64.3							14.3						
	Pork Chops (8)	N/A	0.0	[0.0 - 36.9]										87.5	12.5												
	Chickens (551)	N/A	0.0	[0.0 - 0.7]								0.2	2.2	62.8	34.3	0.5											
	Turkeys (121)	N/A	0.8	[0.0 - 4.5]								0.8	70.2	27.3	0.8					0.8							
	Cattle (200)	N/A	1.0	[0.1 - 3.6]								0.5	64.0	33.5	1.0					1.0							
Swine (120)	N/A	0.0	[0.0 - 3.0]								45.0		53.3	1.7													
Tetracyclines																											
Tetracycline	Humans (2192)	0.2	11.9	[10.6 - 13.3]								87.9	0.2	0.2	2.9	8.8											
	Chicken Breasts (277)	0.4	59.9	[53.9 - 65.7]								39.7	0.4	0.4	59.6												
	Ground Turkey (190)	1.1	65.3	[58.0 - 72.0]								33.7	1.1	1.1	1.1	63.2											
	Ground Beef (14)	0.0	42.9	[17.7 - 71.1]								57.1					42.9										
	Pork Chops (8)	0.0	37.5	[8.5 - 75.5]								62.5			12.5	25.0											
	Chickens (551)	1.1	33.9	[30.0 - 38.1]								65.0	1.1			0.5	33.4										
	Turkeys (121)	0.0	63.6	[54.4 - 72.2]								36.4			8.3	55.4											
	Cattle (200)	0.0	29.0	[22.8 - 35.8]								71.0			0.5	5.5	23.0										
	Swine (120)	0.0	53.3	[44.0 - 62.5]								46.7			14.2	39.2											

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates with resistance. Discrepancies between %R and sums of distribution %'s, to the right of the double vertical bars, are due to rounding

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, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2380	2192	
	Chicken Breasts					60	83	157	153	152	99	199	277	
	Ground Turkey					74	114	142	183	159	190	245	190	
	Ground Beef					9	10	14	8	19	13	24	14	
	Pork Chops					10	5	11	9	8	18	23	8	
	Chickens	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	
	Turkeys	240	713	518	550	244	262	236	227	304	271	148	121	
	Cattle	284	1610	1388	893	1008	670	607	329	389	439	443	200	
Swine	793	876	451	418	379	211	308	301	304	211	111	120		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Aminoglycosides	Amikacin (MIC ≥ 64 µg/ml)	Humans	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	<0.1%	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%
		Ground Turkey					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%
		Pork Chops					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%
		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%	0.5%	0.0%	0.0%
	Gentamicin (MIC ≥ 16 µg/ml)	Humans	2.8%	2.1%	2.7%	1.9%	1.4%	1.4%	1.3%	2.2%	2.0%	2.1%	1.5%	1.3%
		Chicken Breasts					10.0%	6.0%	3.8%	3.3%	9.2%	6.1%	7.0%	3.6%
		Ground Turkey					14.9%	22.8%	20.4%	26.8%	28.9%	24.7%	27.8%	18.4%
		Ground Beef					0.0%	0.0%	0.0%	25.0%	0.0%	7.7%	8.3%	14.3%
		Pork Chops					30.0%	0.0%	0.0%	0.0%	50.0%	5.6%	13.0%	0.0%
		Chickens	15.3%	10.4%	14.9%	7.9%	5.5%	6.3%	4.9%	4.3%	5.7%	4.5%	5.6%	5.6%
		Turkeys	18.3%	17.5%	16.2%	20.9%	19.3%	21.0%	25.4%	22.9%	16.4%	12.9%	16.9%	14.9%
		Cattle	1.8%	1.6%	2.1%	2.1%	2.6%	2.7%	1.8%	2.4%	3.9%	1.6%	1.6%	2.0%
		Swine	0.8%	1.1%	1.3%	1.4%	0.8%	0.5%	1.3%	2.7%	2.0%	0.9%	2.7%	0.0%
	Kanamycin (MIC ≥ 64 µg/ml)	Humans	5.7%	4.4%	5.6%	4.8%	3.8%	3.5%	2.8%	3.4%	2.9%	2.8%	2.1%	2.5%
		Chicken Breasts					6.7%	4.8%	11.5%	4.6%	9.9%	5.1%	10.6%	15.2%
		Ground Turkey					18.9%	27.2%	18.3%	20.2%	15.1%	23.7%	18.0%	6.8%
		Ground Beef					0.0%	0.0%	0.0%	25.0%	5.3%	0.0%	8.3%	14.3%
		Pork Chops					10.0%	0.0%	9.1%	0.0%	25.0%	5.6%	0.0%	12.5%
		Chickens	3.2%	1.2%	4.1%	2.4%	2.0%	2.8%	2.7%	2.5%	3.6%	3.4%	3.4%	3.1%
		Turkeys	17.1%	21.5%	21.4%	22.9%	24.2%	16.0%	14.4%	19.8%	10.5%	16.2%	14.2%	10.7%
		Cattle	9.5%	7.1%	6.6%	6.9%	10.1%	13.7%	8.9%	13.1%	9.5%	7.7%	9.9%	9.0%
		Swine	7.2%	6.7%	9.3%	6.9%	4.2%	5.7%	3.9%	5.0%	8.6%	7.1%	3.6%	4.2%
	Streptomycin (MIC ≥ 64 µg/ml)	Humans	18.7%	16.7%	16.3%	17.1%	13.2%	15.0%	12.0%	11.1%	10.7%	10.4%	10.0%	8.9%
		Chicken Breasts					28.3%	26.5%	28.0%	30.1%	36.2%	30.3%	23.6%	23.1%
		Ground Turkey					37.8%	45.6%	34.5%	44.3%	40.9%	45.8%	58.8%	27.9%
		Ground Beef					22.2%	40.0%	14.3%	25.0%	10.5%	0.0%	20.8%	28.6%
		Pork Chops					70.0%	40.0%	27.3%	33.3%	25.0%	16.7%	13.0%	37.5%
		Chickens	27.8%	27.5%	28.6%	21.0%	22.9%	19.6%	22.2%	23.3%	21.2%	19.3%	25.2%	30.5%
		Turkeys	40.8%	43.6%	41.9%	46.7%	37.7%	29.4%	33.9%	40.1%	28.9%	34.7%	32.4%	38.8%
		Cattle	16.2%	15.4%	21.3%	20.3%	25.9%	28.7%	20.9%	24.3%	23.7%	19.8%	23.0%	22.0%
		Swine	29.4%	29.3%	39.2%	35.6%	40.1%	30.8%	36.4%	36.5%	26.3%	27.0%	29.7%	29.2%

Table 8b. Antimicrobial Resistance among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2380	2192	
	Chicken Breasts					60	83	157	153	152	99	199	277	
	Ground Turkey					74	114	142	183	159	190	245	190	
	Ground Beef					9	10	14	8	19	13	24	14	
	Pork Chops					10	5	11	9	8	18	23	8	
	Chickens	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	
	Turkeys	240	713	518	550	244	262	236	227	304	271	148	121	
	Cattle	284	1610	1388	893	1008	670	607	329	389	439	443	200	
	Swine	793	876	451	418	379	211	308	301	304	211	111	120	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	1.7%	2.3%	3.9%	4.7%	5.3%	4.6%	3.7%	3.2%	3.7%	3.3%	3.1%	3.4%
		Chicken Breasts	25	34	54	66	106	86	66	65	81	70	73	75
		Ground Turkey					10.0%	25.3%	24.8%	21.6%	19.1%	16.2%	22.6%	37.2%
		Ground Beef					6	21	39	33	29	16	45	103
		Pork Chops					12.2%	11.4%	7.7%	8.7%	5.0%	5.3%	5.3%	5.8%
		Chickens	2.0%	4.9%	7.3%	4.5%	10.2%	9.7%	12.4%	12.1%	12.9%	15.6%	8.7%	12.9%
		Turkeys	0.4%	4.3%	3.5%	6.9%	3.7%	1.5%	4.7%	3.5%	5.6%	11.1%	5.4%	13.2%
		Cattle	2.5%	3.9%	9.9%	11.8%	17.7%	21.0%	13.5%	21.0%	18.5%	15.5%	16.5%	15.0%
		Swine	0.4%	1.0%	1.8%	2.6%	3.7%	3.8%	1.9%	4.3%	2.3%	3.3%	4.5%	4.2%
Cepheids	Cefoxitin (MIC ≥ 32 µg/ml)	Humans			3.2%	3.4%	4.3%	4.3%	3.4%	3.0%	3.5%	2.9%	3.0%	3.2%
		Chicken Breasts			44	48	86	79	61	62	77	63	72	71
		Ground Turkey					10.0%	25.3%	24.8%	20.9%	18.4%	15.2%	21.6%	32.5%
		Ground Beef					6	21	39	32	28	15	43	90
		Pork Chops					8.1%	2.6%	4.9%	7.1%	5.0%	5.3%	4.5%	5.8%
		Chickens			7.2%	4.1%	8.7%	8.2%	12.4%	12.0%	12.8%	13.0%	8.0%	11.4%
		Turkeys			85	53	130	95	159	238	176	129	50	63
		Cattle			17	25	6	3	12	8	16	25	8	15
		Swine			9.1%	11.1%	15.9%	17.8%	13.2%	19.8%	17.7%	15.0%	14.7%	13.5%
	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	0.8%	2.0%	3.2%	4.1%	4.4%	4.5%	3.4%	2.9%	3.6%	3.3%	3.0%	3.4%
		Chicken Breasts	12	30	44	58	87	83	60	60	79	70	72	75
		Ground Turkey					10.0%	25.3%	24.8%	20.9%	19.1%	16.2%	22.6%	36.8%
		Ground Beef					6	21	39	32	29	16	45	102
		Pork Chops					8.1%	2.6%	4.9%	7.1%	5.0%	5.3%	4.5%	5.8%
		Chickens	2.0%	5.2%	7.6%	4.1%	10.2%	9.8%	12.4%	12.2%	12.8%	15.4%	8.7%	12.7%
		Turkeys	0.4%	4.6%	3.3%	5.1%	3.3%	1.5%	4.7%	3.5%	5.3%	11.1%	5.4%	12.4%
		Cattle	2.1%	4.2%	9.8%	11.4%	17.4%	21.0%	13.3%	21.6%	18.8%	15.5%	16.3%	14.5%
		Swine	0.1%	1.9%	1.3%	2.2%	3.2%	4.3%	1.9%	3.7%	2.0%	2.8%	4.5%	4.2%
	Ceftriaxone (MIC ≥ 4 µg/ml)	Humans	0.8%	2.0%	3.2%	3.7%	4.4%	4.4%	3.3%	2.9%	3.7%	3.3%	3.0%	3.4%
		Chicken Breasts	12	30	44	52	87	81	59	59	80	70	72	75
		Ground Turkey					10.0%	26.5%	24.8%	21.6%	19.1%	16.2%	22.6%	37.5%
		Ground Beef					6	22	39	33	29	16	45	104
		Pork Chops					8.1%	2.6%	5.6%	7.1%	5.0%	5.8%	4.5%	5.8%
		Chickens	1.8%	4.6%	7.4%	4.1%	9.9%	9.7%	12.3%	12.2%	12.8%	15.6%	8.7%	12.9%
		Turkeys	0.4%	4.2%	3.1%	4.7%	3.3%	1.1%	4.7%	3.5%	5.3%	11.1%	5.4%	12.4%
		Cattle	2.1%	3.9%	9.9%	11.3%	17.3%	21.0%	13.5%	20.7%	18.5%	15.9%	16.0%	14.5%
		Swine	0.1%	1.3%	1.3%	2.2%	2.9%	4.3%	1.6%	3.7%	1.6%	2.4%	4.5%	4.2%

Table 8d. Antimicrobial Resistance among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

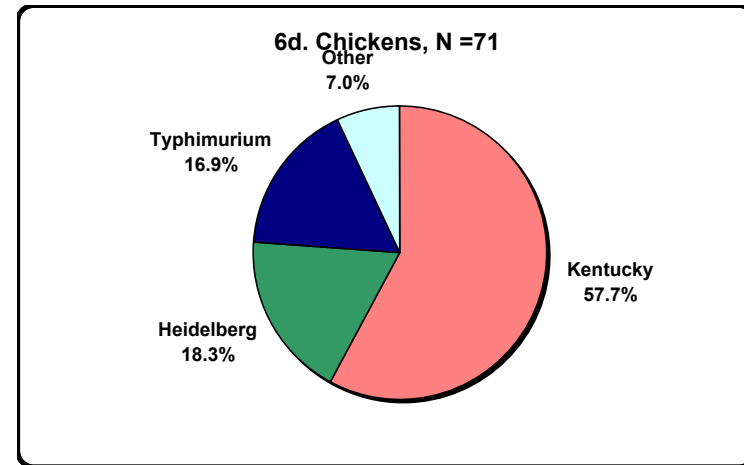
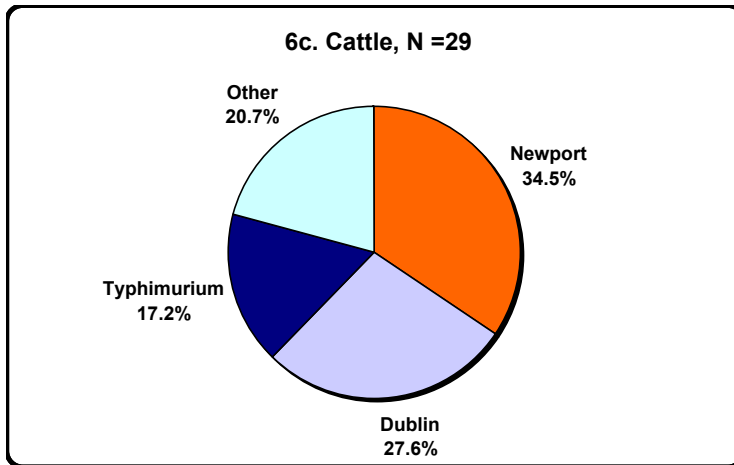
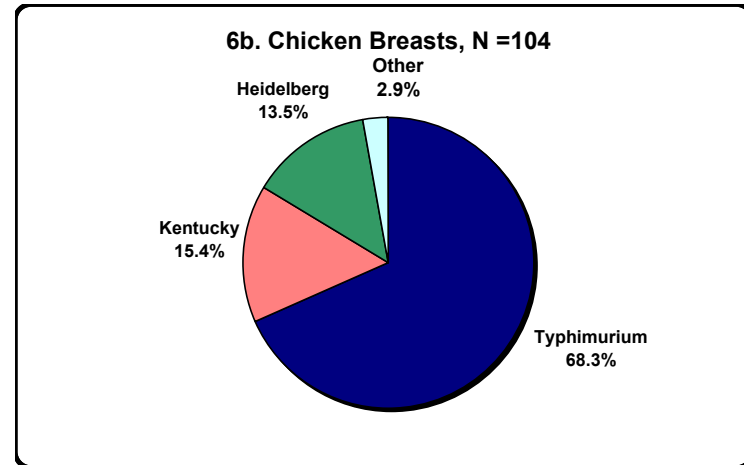
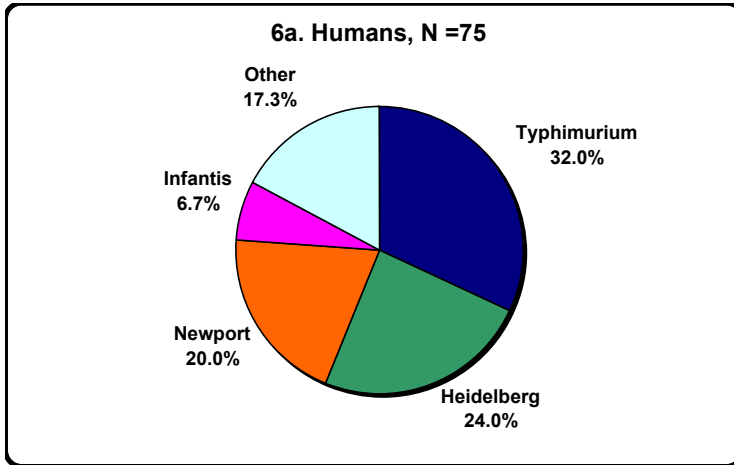
Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2380	2192	
	Chicken Breasts					60	83	157	153	152	99	199	277	
	Ground Turkey					74	114	142	183	159	190	245	190	
	Ground Beef					9	10	14	8	19	13	24	14	
	Pork Chops					10	5	11	9	8	18	23	8	
	Chickens	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	
	Turkeys	240	713	518	550	244	262	236	227	304	271	148	121	
	Cattle	284	1610	1388	893	1008	670	607	329	389	439	443	200	
	Swine	793	876	451	418	379	211	308	301	304	211	111	120	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	0.1%	0.1%	0.4%	0.2%	<0.1%	0.2%	0.2%	<0.1%	0.1%	<0.1%	0.0%	
			1	1	5	3	1	3	4	1	2	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%	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%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%		
		0	0	0	0	0	1	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	0	0	0		
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	1.3%	0.9%	2.3%	2.3%	1.6%	1.9%	2.2%	1.9%	2.4%	2.3%	2.0%	1.8%
			19	14	32	32	32	36	39	38	52	49	47	39
Chicken Breasts						0.0%	1.2%	0.0%	0.7%	0.7%	0.0%	0.0%	0.4%	
						0	1	0	1	1	0	0	1	
Ground Turkey						8.1%	4.4%	0.0%	1.1%	0.0%	2.6%	0.4%	0.0%	
						6	5	0	2	0	5	1	0	
Ground Beef						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.3%	
						0	0	0	0	0	0	0	2	
Pork Chops						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
					0	0	0	0	0	0	0	0		
Chickens	0.2%	0.2%	0.5%	0.0%	0.8%	0.4%	0.5%	0.3%	0.1%	0.1%	0.0%	0.0%		
	1	3	6	0	12	5	6	6	2	1	0	0		
Turkeys	2.1%	5.3%	5.4%	5.1%	5.3%	3.8%	2.1%	2.2%	0.7%	1.1%	0.7%	0.8%		
	5	38	28	28	13	10	5	5	2	3	1	1		
Cattle	0.4%	0.1%	0.4%	0.4%	0.4%	0.4%	2.0%	1.5%	0.5%	0.7%	0.7%	1.0%		
	1	1	6	4	4	3	12	5	2	3	3	2		
Swine	0.0%	0.0%	0.2%	0.0%	0.3%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%		
	0	0	1	0	1	0	0	1	0	0	0	0		
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	20.3%	19.4%	18.7%	19.9%	14.9%	16.3%	13.6%	13.9%	13.5%	14.5%	11.6%	11.9%
			295	289	256	280	298	303	242	282	293	310	275	261
		Chicken Breasts					33.3%	27.7%	46.5%	43.8%	46.7%	41.4%	46.7%	59.9%
							20	23	73	67	71	41	93	166
		Ground Turkey					55.4%	39.5%	56.3%	39.9%	56.0%	67.4%	66.1%	65.3%
							41	45	80	73	89	128	162	124
		Ground Beef					22.2%	40.0%	14.3%	12.5%	21.1%	0.0%	20.8%	42.9%
							2	4	2	1	4	0	5	6
		Pork Chops					70.0%	80.0%	54.5%	55.6%	25.0%	50.0%	34.8%	37.5%
							7	4	6	5	2	9	8	3
		Chickens	20.5%	25.0%	26.3%	21.9%	24.9%	26.2%	27.4%	28.3%	31.8%	35.5%	30.4%	33.9%
	115	359	308	286	374	303	351	563	439	353	190	187		
Turkeys	45.8%	52.9%	56.2%	54.9%	54.5%	58.8%	48.3%	54.6%	61.8%	73.8%	64.2%	63.6%		
	110	377	291	302	133	154	114	124	188	200	95	77		
Cattle	24.3%	20.9%	25.8%	26.3%	32.0%	36.9%	31.8%	34.0%	30.3%	27.3%	29.3%	29.0%		
	69	336	358	235	323	247	193	112	118	120	130	58		
Swine	47.5%	48.4%	54.3%	53.1%	57.8%	43.1%	58.8%	54.8%	62.8%	54.5%	51.4%	53.3%		
	377	424	245	222	219	91	181	165	191	115	57	64		

Ceftriaxone Resistance

Table 9. Ceftriaxone-Resistant Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Source and Serotype, 2009

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (N=75)	Typhimurium	24	32.0	Chicken Breasts (N=104)	Typhimurium	71	68.3	Chickens (N=71)	Kentucky	41	57.7
	Heidelberg	18	24.0		Kentucky	16	15.4		Heidelberg	13	18.3
	Newport	15	20.0		Heidelberg	14	13.5		Typhimurium	12	16.9
	Infantis	5	6.7		I 4,12:nonmotile	1	1.0		I 4,[5],12:i:-	2	2.8
	I 4,[5],12:i:-	2	2.7		Agona	1	1.0		Cerro	1	1.4
	Agona	2	2.7	Enteritis	1	1.0	Enteritidis	1	1.4		
	Bardo	2	2.7	Ground Turkey (N=11)	Senftenberg	3	27.3	Turkeys (N=15)	Agona	7	46.7
	Dublin	2	2.7		Derby	2	18.2		Senftenberg	2	13.3
	Derby	1	1.3		Agona	1	9.1		Anatum	1	6.7
	Javiana	1	1.3		Alachua	1	9.1		Derby	1	6.7
	Paratyphi B var. L(+) tartrate+	1	1.3		Albany	1	9.1		Heidelberg	1	6.7
	Schwarzengrund	1	1.3		Heidelberg	1	9.1		Infantis	1	6.7
	Unknown serotype	1	1.3		Infantis	1	9.1		Newport	1	6.7
					Schwarzengrund	1	9.1		Typhimurium	1	6.7
				Ground Beef (N=2)	Dublin	2	100.0	Cattle (N=29)	Newport	10	34.5
							Dublin		8	27.6	
							Typhimurium		5	17.2	
							III 61:-:1,5,7		1	3.4	
							Agona		1	3.4	
							Give		1	3.4	
							Meleagridis		1	3.4	
						Montevideo	1	3.4			
						Rough O:g,p:-	1	3.4			
			Pork Chops (N=2)	Heidelberg	1	50.0	Swine (N=5)	Agona	2	40.0	
				Infantis	1	50.0		Derby	1	20.0	
						Havana		1	20.0		
						Johannesburg		1	20.0		

Figures 6a-d. Ceftriaxone-Resistant Non-Typhoidal *Salmonella* Isolates, by Source and Serotype, 2009¹



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, 1996-2009

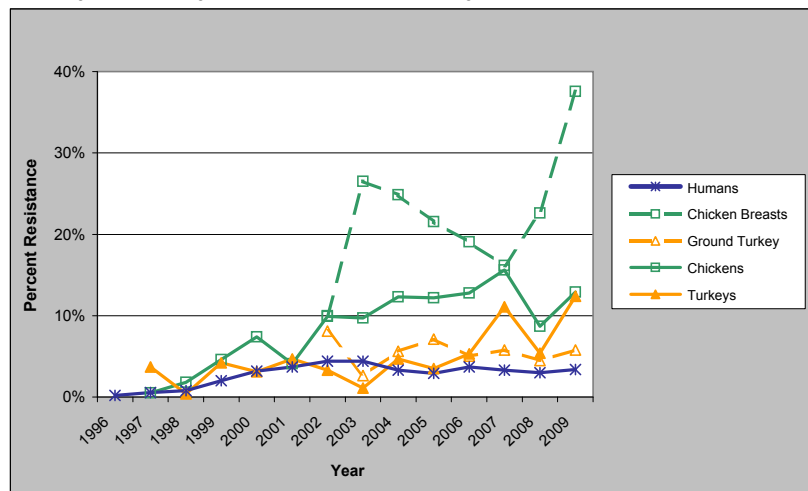
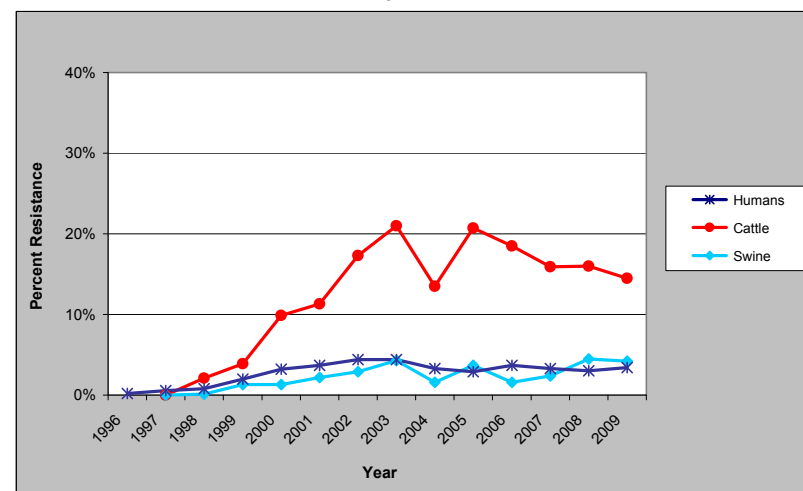


Figure 8. Percent of Non-Typhoidal *Salmonella* Isolates from Humans, Cattle, and Swine Resistant to Ceftriaxone, by Year, 1996-2009¹



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, 1996-2009

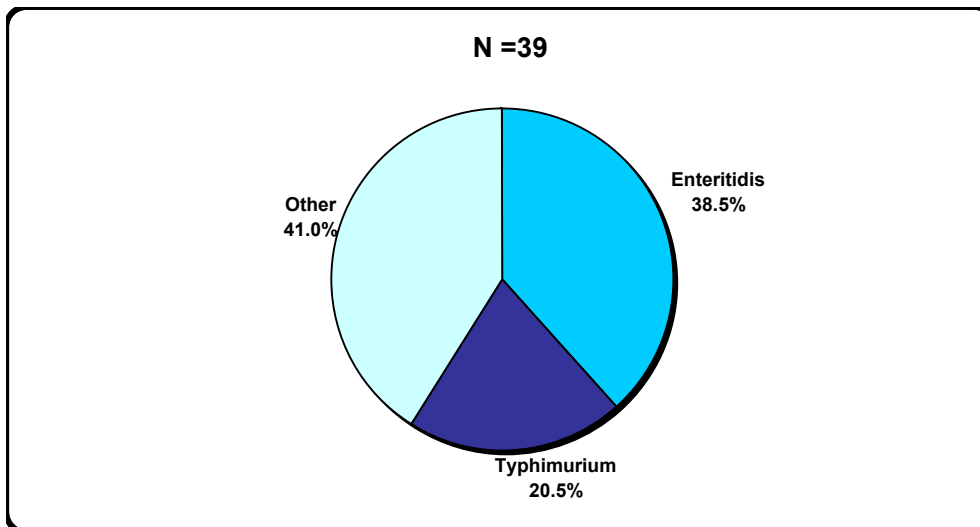
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	1318	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2380	2192
Chicken Breasts							60	83	157	153	152	99	199	277
Ground Turkey							74	114	142	183	159	190	245	190
Ground Beef							9	10	14	8	19	13	24	14
Pork Chops							10	5	11	9	8	18	23	8
Chickens		214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551
Turkeys		107	240	713	518	550	244	262	236	227	304	271	148	121
Cattle		24	284	1610	1388	893	1008	670	607	329	389	439	443	200
Swine		111	793	876	451	418	379	211	308	301	304	211	111	120

Nalidixic Acid Resistance

Table 11. Nalidixic Acid-Resistant Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Source and Serotype, 2009

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (N=39)	Enteritidis	15	38.5	Chicken Breasts (N=1)	Enteritidis	1	100.0	Chickens (N=0)			
	Typhimurium	8	20.5								
	Virchow	3	7.7								
	Nitra	2	5.1								
	Agona	1	2.6								
	Derby	1	2.6								
	Dublin	1	2.6								
	Hadar	1	2.6								
	Infantis	1	2.6								
	Javiana	1	2.6								
	Kentucky	1	2.6								
	Saintpaul	1	2.6								
	Unknown serotype	2	5.1								
	Partially serotyped	1	2.6								
						Ground Turkey (N=0)					Turkeys (N=1)
				Ground Beef (N=2)	Dublin	2	100.0	Cattle (N=2)	Dublin	2	100.0
				Pork Chops (N=0)				Swine (N=0)			

Figure 9. Nalidixic Acid-Resistant Non-Typhoidal *Salmonella* Isolates from Humans, by Serotype, 2009¹



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, 1996-2009

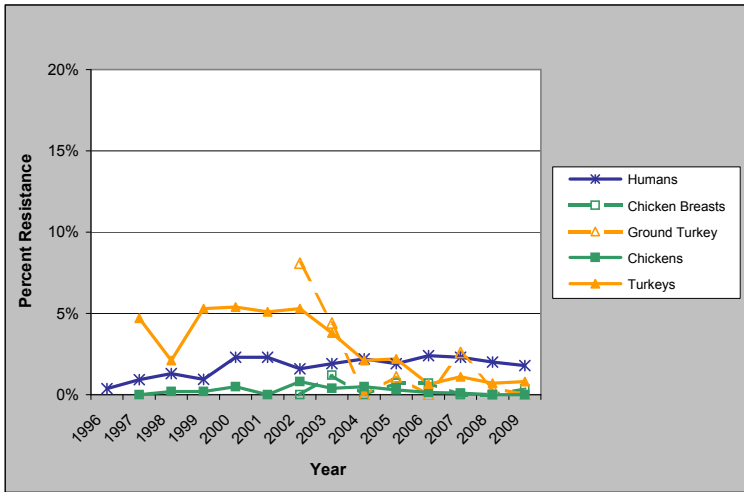
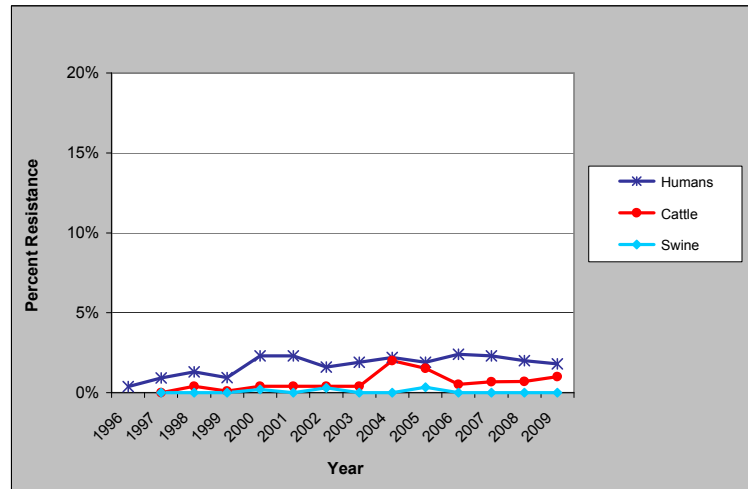


Figure 11. Percent of non-Typhoidal *Salmonella* Isolates from Humans, Cattle, and Swine Resistant to Nalidixic Acid, by Year, 1996-2009 ¹



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, 1996-2009

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	1318	1297	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2380	2192
Chicken Breasts							60	83	157	153	152	99	199	277
Ground Turkey							74	114	142	183	159	190	245	190
Ground Beef							9	10	14	8	19	13	24	14
Pork Chops							10	5	11	9	8	18	23	8
Chickens		214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551
Turkeys		107	240	713	518	550	244	262	236	227	304	271	148	121
Cattle		24	284	1610	1388	893	1008	670	607	329	389	439	443	200
Swine		111	793	876	451	418	379	211	308	301	304	211	111	120

Resistance among Top *Salmonella* Serotypes

Table 13. Number of Resistant Non-Typhoidal *Salmonella* Isolates from Humans, by Serotype, 2009

<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
Enteritidis	410	18.7%	377	23	8	2			1	5					7	3	16				15	5	
Typhimurium	371	16.9%	236	12	34	75	13	1	7	18	96		23	20	24	24	111	11	104	76	8	107	
Newport	236	10.8%	212	4	4	1	15	1	3	18		16	14	15	15	19	1	18	16			19	
Javiana	105	4.8%	103	1		1						1	1	1	1		2				1		
Heidelberg	86	3.9%	52	4	15	13	2	2	18	20		18	17	18	18	6	3	24	4			24	
I 4,[5],12:i-	72	3.3%	55	5	5	6	1	2		9		3	2	2	2	10	1	8	6			12	
Oranienburg	64	2.9%	64																				
Saintpaul	57	2.6%	51	2	3	1		2		1					3	1	2		1		1	3	
Montevideo	56	2.6%	52		4			4	1	3					4							1	
Braenderup	46	2.1%	46																				
Infantis	44	2.0%	37		3	2	2			3	3		4	5	5	5	3	1	6	2		1	5
Others	645	29.4%	538	34	49	16	7	1	10	10	41		10	12	10	10	54	17	36	20	1	13	85
Total	2192	100.0%	1823	85	125	117	40	2	28	54	196		75	71	75	217	38	216	125	1	39	261	

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, 2009

<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
Typhimurium	123	44.4%	3	45	44	31		3	34	19		71	58	70	71	119		84					118
Heidelberg	45	16.2%	28		13	4		1	7	6		14	14	14	14	1		14					7
Kentucky	44	15.9%	7	2	23	12		1		31		16	16	16	2			17					30
Enteritidis	27	9.7%	20	6		1						1	1	1	1	1	1	5				1	1
I 4[5],12:i-	8	2.9%	6		2			1		1						2							2
Other	30	10.8%	17	4	5	4		4	1	7		1	1	1	2	8		7					8
Total	277	100.0%	81	12	88	65	31	10	42	64		103	90	102	104	133	1	127					166

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, 2009

<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		
Saintpaul	76	40.0%	7	5	58	6									6	3	65					67			
Hadar	20	10.5%		1	19										2		11					18			
Illia 18:z4,z23:-	18	9.5%	18																						
Heidelberg	10	5.3%	1		6	3				7	2	6		1	1	1	1	5				6			
Senftenberg	10	5.3%	3		4	1	2			3	3	3		3	3	3	4		2			1			
I 4,12:d:-	9	4.7%			6	3										2						9			
Schwarzengrund	9	4.7%	4	1	3	1				1	1	1		1	1	1	2					4			
Albany	6	3.2%	3		2		1			2		3		1	1	1	2					2			
Derby	5	2.6%			3	2				3		3		2	2	2	3					5			
I 4,5,12:r:-	4	2.1%				4				4		4				4						4			
Montevideo	4	2.1%			4					1	2	3													
Other	19	10.0%	6	2	8	1	2			9	1	7		3	3	3	3	8		8	1	8			
Total	190	100.0%	42	19	106	18	5			35	13	53		11	11	11	11	38	3	110	3	124			

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, 2009

<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		
Montevideo	4	28.6%	4																						
Dublin	3	21.4%			1	2					2	3		2	2	2	3		2		3	2	3		
Saintpaul	3	21.4%		1	2					2		1				2		2				3			
Newport	2	14.3%	2																						
Give	1	7.1%	1																						
Muenster	1	7.1%	1																						
Total	14	100.0%	8	1	3	2				2	2	4		2	2	2	5	4	3	2	6	6			

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, 2009

<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																				
Derby	3	37.5%	2	1					1						1							1	
Infantis	2	25.0%	1	1						1		1	1	1			1						
Heidelberg	1	12.5%				1		1	1	1	1	1	1	1	1		1					1	
Ohio	1	12.5%	1																				
Typhimurium	1	12.5%				1			1						1	1	1					1	
Total	8	100.0%	4	2	1	1		1	3	2		2	2	2	3	2	3		1			3	

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, 2009

<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	214	38.8%	74	25	74	37	4	5	5	117	41	37	40	41	5		42					123	
Enteritidis	118	21.4%	114	2	1	1				1			1	1			3					3	
Heidelberg	74	13.4%	41	6	20	3	4	17	9	20	13	13	13	16			15		4			11	
Typhimurium	36	6.5%	12	3	12	7	2		3	2	12	10	12	12	19	1	12					20	
I 4,[5],12:i:-	21	3.8%	16	2	2	1		1		2	2	1	2	2	2		2					2	
I 8,20:-:z6	13	2.4%			3	10				10					5							13	
Other	75	13.6%	52	4	17	2		8		17	2	2	2	2	8		2			1		15	
Total	551	99.9%	309	45	136	51	10	31	17	168	71	63	70	71	55	1	76		9			187	

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 Turkeys, by Serotype, 2009

<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		Phenicols		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	32	26.4%	3	29			1	4	22					1		17						32	
Saintpaul	18	14.9%	3	3	11	1		2	4					4	1	8						12	
Agona	15	12.4%	2		8	2	3	2		5	7		7	7	7	11	1	8		3		9	
Schwarzengrund	7	5.8%	3	3	1			1		1						1						4	
Senftenberg	7	5.8%	3	1	2		1	2	1	1	2		2	2	2	1		3				1	
Illa 18:z4,z23:-	6	5.0%	6																				
Albany	5	4.1%	2	1	2			2		2					3								
Derby	4	3.3%		1	1	1	1	1		1		1	1	1	3		2		1			4	
Heidelberg	3	2.5%	1		1	1		1	2	2	1		1	1	1		2					2	
Muenchen	3	2.5%	1		2					2					2							2	
Newport	3	2.5%			2		1	2	1	2	1		1	1	1	3		1				1	
Other	18	14.9%	3	3	9	1	2	4	1	9	4		3	3	3	7		5			1	10	
Total	121	100.0%	24	15	68	6	8	18	13	47	16		15	15	15	35	2	47		4	1	77	

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, 2009

<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		Phenicols		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	59	29.5%	55	3		1			1	1		1	1	1	1		1		1			4	
Dublin	21	10.5%	4	1		8	8	2	7	11	9		8	8	8	15		11		15		2	15
Typhimurium	18	9.0%	1	1	2	10	4		6	13	5		4	5	5	15	1	15		12		16	
Newport	17	8.5%	5			2	10		1	12	10		9	10	10	12		11		9		12	
Kentucky	10	5.0%	10																				
Cerro	9	4.5%	9																				
Meleagridis	8	4.0%	7		1						1		1	1	1		1						
Anatum	7	3.5%	5	2																		2	
Muenchen	6	3.0%	5	1																		1	
Agona	5	2.5%	3			1	1		1	2	1		1	1	1	2	1	1		2		2	
Muenster	4	2.0%	4																				
Other	36	18.0%	29	2	1	2	2	2	3	5	3		3	3	3	4	1	5		3		6	
Total	200	100.0%	137	10	4	23	26	4	18	44	30		27	29	29	49	3	45		42	2	58	

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, 2009

<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	24	20.0%	4	5	14	1				14	1		1	1	1	15	1	1		1			20
Typhimurium	20	16.7%		1	4	15				16						18	1	16		15			20
Johannesburg	11	9.2%	4	6	1					1		1	1	1			1						6
Anatum	10	8.3%	5	5																			5
Infantis	10	8.3%	9		1										1		1						1
Adelaide	5	4.2%	5																				
Agona	4	3.3%	2			2				2	2		2	2	2	2	1	2		2			2
Bredeney	4	3.3%	3		1					1													1
Heidelberg	4	3.3%		2	2					2	2												4
Saintpaul	4	3.3%	3		1										1		1						1
Other	24	20.0%	18	5	1					1		1	1	1			1						4
Total	120	100.0%	53	24	25	15	3			5	35	5	5	5	5	37	3	23		18			64

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, 1998-2009

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested													
Humans	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2380	2192	
Chicken Breasts					60	83	157	153	152	99	199	277	
Ground Turkey					74	114	142	183	159	190	245	190	
Ground Beef					9	10	14	8	19	13	24	14	
Pork Chops					10	5	11	9	8	18	23	8	
Chickens	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	
Turkeys	240	713	518	550	244	262	236	227	304	271	148	121	
Cattle	284	1610	1388	893	1008	670	607	329	389	439	443	200	
Swine	793	876	451	418	379	211	308	301	304	211	111	120	
Resistance Pattern	Isolate Source												
1. No Resistance Detected	Humans	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	83.2% 1823
	Chicken Breasts					51.7% 31	45.8% 38	40.1% 63	46.4% 71	38.8% 59	47.5% 47	45.7% 91	29.2% 81
	Ground Turkey					37.8% 28	34.2% 39	28.9% 41	30.1% 55	17.6% 28	15.3% 29	20.8% 51	22.1% 42
	Ground Beef					77.8% 7	60.0% 6	78.6% 11	75.0% 6	73.7% 14	92.3% 12	79.2% 19	57.1% 8
	Pork Chops					20.0% 2	20.0% 1	45.5% 5	44.4% 4	25.0% 2	44.4% 8	65.2% 15	50.0% 4
	Chickens	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	56.1% 309
	Turkeys	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	19.8% 24
	Cattle	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	68.5% 137
	Swine	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	44.2% 53
2. Resistant to ≥ 3 Antimicrobial Classes	Humans	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	9.5% 209
	Chicken Breasts					20.0% 12	30.1% 25	34.4% 54	25.5% 39	24.3% 37	25.3% 25	38.2% 76	48.4% 134
	Ground Turkey					21.6% 16	31.6% 36	26.1% 37	29.0% 53	24.5% 39	42.6% 81	51.0% 125	26.3% 50
	Ground Beef					22.2% 2	40.0% 4	14.3% 2	25.0% 2	10.5% 2	0.0% 0	20.8% 5	35.7% 5
	Pork Chops					60.0% 6	40.0% 2	18.2% 2	22.2% 2	25.0% 2	5.6% 1	17.4% 4	50.0% 4
	Chickens	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	15.6% 86
	Turkeys	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	33.1% 40
	Cattle	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	26.0% 52
	Swine	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	31.7% 38
3. Resistant to ≥ 4 Antimicrobial Classes	Humans	12.8% 186	11.9% 177	12.7% 174	13.5% 191	9.8% 195	11.4% 211	9.3% 165	9.1% 185	8.1% 177	8.2% 176	7.4% 177	7.3% 159
	Chicken Breasts					5.0% 3	16.9% 14	24.2% 38	18.3% 28	15.1% 23	13.1% 13	23.1% 46	34.7% 96
	Ground Turkey					13.5% 10	24.6% 28	12.7% 18	7.7% 14	8.2% 13	14.7% 28	15.1% 37	12.1% 23
	Ground Beef					22.2% 2	40.0% 4	14.3% 2	12.5% 1	5.3% 1	0.0% 0	12.5% 3	35.7% 5
	Pork Chops					40.0% 4	40.0% 2	18.2% 2	22.2% 2	25.0% 2	5.6% 1	13.0% 3	25.0% 2
	Chickens	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	11.1% 61
	Turkeys	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	11.6% 14
	Cattle	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	24.5% 49
	Swine	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	15.0% 18
4. Resistant to ≥ 5 Antimicrobial Classes	Humans	9.8% 142	8.5% 127	9.5% 131	10.3% 145	8.2% 164	9.8% 182	8.0% 142	7.2% 146	6.3% 137	6.9% 149	6.6% 157	6.3% 137
	Chicken Breasts					3.3% 2	13.3% 11	22.3% 35	17.7% 27	14.5% 22	12.1% 12	19.1% 38	31.4% 87
	Ground Turkey					12.2% 9	14.0% 16	4.9% 7	2.7% 5	3.1% 5	3.2% 6	2.9% 7	3.7% 7
	Ground Beef					22.2% 2	40.0% 4	14.3% 2	12.5% 1	5.3% 1	0.0% 0	12.5% 3	14.3% 2
	Pork Chops					40.0% 4	40.0% 2	9.1% 1	22.2% 2	0.0% 0	0.0% 0	0.0% 0	25.0% 2
	Chickens	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	7.8% 43
	Turkeys	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	9.1% 11
	Cattle	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	20.0% 40
	Swine	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	14.2% 17

Table 22b. Resistance Patterns among all Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	1455	1493	1372	1410	1998	1855	1782	2034	2173	2144	2380	2192
	Chicken Breasts					60	83	157	153	152	99	199	277
	Ground Turkey					74	114	142	183	159	190	245	190
	Ground Beef					9	10	14	8	19	13	24	14
	Pork Chops					10	5	11	9	8	18	23	8
	Chickens	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551
	Turkeys	240	713	518	550	244	262	236	227	304	271	148	121
	Cattle	284	1610	1388	893	1008	670	607	329	389	439	443	200
	Swine	793	876	451	418	379	211	308	301	304	211	111	120
	Resistance Pattern	Isolate Source											
5. At Least ACSSuT¹ Resistant	Humans	8.9% 130	8.4% 125	8.9% 122	10.1% 142	7.8% 156	9.3% 173	7.2% 129	6.9% 141	5.6% 121	6.3% 136	5.8% 138	5.1% 112
	Chicken Breasts					0.0% 0	2.4% 2	1.9% 3	0.7% 1	2.6% 4	0.0% 0	0.5% 1	0.0% 0
	Ground Turkey					1.4% 1	0.9% 1	2.8% 4	0.5% 1	0.6% 1	1.6% 3	1.6% 4	0.5% 1
	Ground Beef					22.2% 2	40.0% 4	14.3% 2	12.5% 1	5.3% 1	0.0% 0	12.5% 3	14.3% 2
	Pork Chops					40.0% 4	40.0% 2	9.1% 1	22.2% 2	0.0% 0	0.0% 0	0.0% 0	12.5% 1
	Chickens	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	1.3% 7
	Turkeys	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	3.3% 4
	Cattle	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	15.0% 30
	Swine	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	13.3% 16
	6. At Least ACT/S² Resistant	Humans	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	0.5% 11
Chicken Breasts						0.0% 0	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	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	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	12.5% 1
Chickens		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	0.0% 0
Turkeys		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	0.8% 1
Cattle		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	1.5% 3
Swine		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	1.7% 2
7. At Least ACSSuTAuCx³ Resistant		Humans	0.3% 5	1.5% 23	2.6% 35	2.6% 36	3.4% 67	3.2% 60	2.4% 42	2.0% 41	2.0% 43	2.1% 46	1.8% 44
	Chicken Breasts					0.0% 0	0.0% 0	1.9% 3	0.0% 0	2.6% 4	0.0% 0	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	0.5% 1
	Ground Beef					22.2% 2	40.0% 4	14.3% 2	0.0% 0	0.0% 0	0.0% 0	8.3% 2	14.3% 2
	Pork Chops					20.0% 2	20.0% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Chickens	0.5% 3	0.3% 4	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	1.3% 7
	Turkeys	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	2.0% 3	3.3% 4
	Cattle	2.1% 6	3.7% 59	8.9% 124	11.0% 98	14.6% 147	15.1% 101	12.0% 73	17.3% 57	16.2% 63	13.9% 61	14.7% 65	9.5% 19
	Swine	0.1% 1	0.5% 4	1.3% 6	2.2% 9	1.8% 7	1.9% 4	1.0% 3	2.7% 8	0.7% 2	0.5% 1	0.9% 1	1.7% 2
	8. At Least Ceftriaxone and Nalidixic Acid Resistant	Humans	0.0% 0	0.1% 2	0.1% 1	0.1% 2	0.2% 4	0.1% 2	0.1% 2	<0.1% 2	0.1% 3	0.2% 5	0.0% 0
Chicken Breasts						0.0% 0	0.0% 0	0.0% 0	0.7% 1	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	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	14.3% 2
Pork Chops						0.0% 0	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	0.1% 1	0.1% 1	0.0% 0	0.5% 8	0.0% 0	0.2% 2	0.1% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Turkeys		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	0.0% 0
Cattle		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	0.0% 0
Swine		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	0.0% 0

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

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

³ ACSSuTAuCx = ACSSuT, amoxicillin-clavulanic acid, and ceftriaxone

Table 23. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are Resistant to ≥ 3 Antimicrobial Classes, by Serotype, 2009

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (N=209)	Typhimurium	104	49.8	Chicken Breasts (N=134)	Typhimurium	93	69.4	Chickens (N=86)	Kentucky	42	48.8
	Heidelberg	22	10.5		Kentucky	17	12.7		Heidelberg	18	20.9
	Newport	18	8.6		Heidelberg	15	11.2		Typhimurium	14	16.3
	I 4,[5],12:i:-	9	4.3		I 4,[5],12:i:-	1	0.7		I 8,20:-:z6	5	5.8
	Infantis	7	3.3		I 4,12:nonmotile	1	0.7		I 4,[5],12:i:-	2	2.3
	Derby	6	2.9		I 4,5,12:r:-	1	0.7		Agona	1	1.2
	Dublin	4	1.9		Enteritidis	1	0.7		Anatum	1	1.2
	Enteritidis	4	1.9		Hadar	1	0.7		Cerro	1	1.2
	Agona	3	1.4		Mbandaka	1	0.7		Enteritidis	1	1.2
	Hadar	3	1.4		Montevideo	1	0.7		Worthington	1	1.2
	Paratyphi B Var. L(+) Tartrate	3	1.4		Saintpaul	1	0.7				
	Bardo	2	1.0		Senftenberg	1	0.7				
	Saintpaul	2	1.0								
	Virchow	2	1.0								
	Berta	1	0.5	Ground	Saintpaul	9	18.0	Turkeys (N=40)	Hadar	14	35.0
	Bovismorbificans	1	0.5	Turkey (N=50)	Hadar	8	16.0	Agona	8	20.0	
	Cerro	1	0.5	Heidelberg	7	14.0	Derby	2	5.0		
	Javiana	1	0.5	Derby	5	10.0	Heidelberg	2	5.0		
	Kentucky	1	0.5	Senftenberg	5	10.0	Muenchen	2	5.0		
	Kouka	1	0.5	I 4,5,12:r:-	4	8.0	Saintpaul	2	5.0		
	Mississippi	1	0.5	Agona	3	6.0	Senftenberg	2	5.0		
	Montevideo	1	0.5	Albany	2	4.0	I 4,[5],12:r:-	1	2.5		
	Muenchen	1	0.5	Schwarzengrund	2	4.0	Anatum	1	2.5		
	Muenster	1	0.5	I 4,12:d:-	1	2.0	Infantis	1	2.5		
	Nitra	1	0.5	Alachua	1	2.0	Kentucky	1	2.5		
	Schwarzengrund	1	0.5	Berta	1	2.0	Newport	1	2.5		
	Stanley	1	0.5	Infantis	1	2.0	Schwarzengrund	1	2.5		
	Unknown serotype	3	1.4	Kentucky	1	2.0	Typhimurium	1	2.5		
	Partially serotyped	3	1.4				Untypable	1	2.5		
Rough/Nonmotile isolates	1	0.5									
				Ground	Dublin	3	60.0	Cattle (N=52)	Dublin	16	30.8
				Beef (N=5)	Saintpaul	2	40.0	Typhimurium	15	28.8	
							Newport	12	23.1		
							Agona	2	3.8		
							Rough O:g,p:-	2	3.8		
							III 61:-:1,5,7	1	1.9		
							Give	1	1.9		
							Meleagridis	1	1.9		
							Montevideo	1	1.9		
							Senftenberg	1	1.9		
				Pork	Derby	1	25.0	Swine (N=38)	Typhimurium	17	44.7
				Chops (N=4)	Heidelberg	1	25.0	Derby	15	39.5	
					Infantis	1	25.0	Agona	2	5.3	
					Typhimurium	1	25.0	Havana	1	2.6	
							Infantis	1	2.6		
							Johannesburg	1	2.6		
							Saintpaul	1	2.6		

Table 24. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are Resistant to ≥ 4 Antimicrobial Classes, by Serotype, 2009

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (N=159)	Typhimurium	89	56.0	Chicken Breasts (N=96)	Typhimurium	75	78.1	Chickens (N=61)	Kentucky	41	67.2
	Newport	16	10.1		Kentucky	12	12.5		Typhimurium	9	14.8
	Heidelberg	15	9.4		Heidelberg	4	4.2		Heidelberg	7	11.5
	I 4,[5],12:i:-	7	4.4		I 4,12:nonmotile	1	1.0		I 4,[5],12:i:-	1	1.6
	Dublin	4	2.5		I 4,15,12:r:-	1	1.0		Agona	1	1.6
	Infantis	4	2.5		Enteritidis	1	1.0	Cerro	1	1.6	
	Agona	2	1.3		Montevideo	1	1.0	Enteritidis	1	1.6	
	Bardo	2	1.3		Saintpaul	1	1.0				
	Enteritidis	2	1.3								
	Paratyphi B Var. L(+) Tartrate	2	1.3								
	Virchow	2	1.3	Ground Turkey (N=23)	Saintpaul	6	26.1	Turkeys (N=14)	Agona	5	35.7
	Bovismorbificans	1	0.6	I 4,5,12:r:-	4	17.4	Derby		2	14.3	
	Cerro	1	0.6	Heidelberg	3	13.0	I 4,[5],12:r:-		1	7.1	
	Derby	1	0.6	Senftenberg	3	13.0	Heidelberg		1	7.1	
	Javiana	1	0.6	Derby	2	8.7	Infantis		1	7.1	
	Kentucky	1	0.6	Agona	1	4.3	Newport		1	7.1	
	Kouka	1	0.6	Alachua	1	4.3	Saintpaul		1	7.1	
	Mississippi	1	0.6	Albany	1	4.3	Senftenberg	1	7.1		
	Muenster	1	0.6	Infantis	1	4.3	Typhimurium	1	7.1		
	Saintpaul	1	0.6	Schwarzengrund	1	4.3					
	Stanley	1	0.6								
	Unknown serotype	1	0.6	Ground Beef (N=5)	Dublin	3	60.0	Cattle (N=49)	Dublin	16	32.7
	Partially serotyped	2	1.3	Saintpaul	2	40.0	Typhimurium		14	28.6	
	Rough/Nonmotile isolates	1	0.6				Newport		12	24.5	
							Agona		2	4.1	
							Rough O:g,p:-		2	4.1	
							III 61:-:1,5,7		1	2.0	
						Give	1		2.0		
						Montevideo	1	2.0			
				Pork Chops (N=2)	Heidelberg	1	50.0	Swine (N=18)	Typhimurium	15	83.3
				Typhimurium	1	50.0	Agona		2	11.1	
							Derby		1	5.6	

Table 25. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are Resistant to ≥ 5 Antimicrobial Classes, by Serotype, 2009

Humans				Retail Meats				Food Animals			
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%
Humans (N=137)	Typhimurium	82	59.9	Chicken Breasts (N=87)	Typhimurium	70	80.5	Chickens (N=43)	Kentucky	27	62.8
	Newport	15	10.9		Kentucky	11	12.6		Typhimurium	9	20.9
	Heidelberg	13	9.5		Heidelberg	4	4.6		Heidelberg	6	14.0
	I 4,[5],12:i:-	5	3.6		I 4,12:nonmotil	1	1.1		I 4,[5],12:i:-	1	2.3
	Dublin	4	2.9	Enteritidis	1	1.1					
	Agona	2	1.5	Ground Turkey (N=7)	Senftenberg	2	28.6	Turkeys (N=11)	Agona	5	45.5
	Bardo	2	1.5		Agona	1	14.3		Derby	1	9.1
	Infantis	2	1.5		Alachua	1	14.3		Heidelberg	1	9.1
	Paratyphi B Var. L(+) Tartrate	2	1.5		Albanby	1	14.3		Infantis	1	9.1
	Cerro	1	0.7		Heidelberg	1	14.3		Newport	1	9.1
	Derby	1	0.7		Infantis	1	14.3		Senftenberg	1	9.1
	Enteritidis	1	0.7						Typhimurium	1	9.1
	Kentucky	1	0.7	Ground Beef (N=2)	Dublin	2	100.0	Cattle (N=40)	Typhimurium	13	32.5
	Mississippi	1	0.7						Dublin	11	27.5
	Saintpaul	1	0.7						Newport	10	25.0
	Unknown serotype	1	0.7						Rough O:g.p:-	2	5.0
	Partially Serotyped	2	1.5				III 61:-:1,5,7		1	2.5	
	Rough/Nonmotile isolates	1	0.7				Agona		1	2.5	
							Montevideo		1	2.5	
							Give	1	2.5		
				Pork Chops (N=2)	Heidelberg	1	50.0	Swine (N=17)	Typhimurium	14	82.4
					Typhimurium	1	50.0		Agona	2	11.8
							Derby		1	5.9	

Table 26. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are at least ACSSuT¹ Resistant, by Serotype, 2009

Humans				Retail Meats				Food Animals				
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%	
Humans (N=112)	Typhimurium	72	64.3	Chicken Breasts (N=0)				Chickens (N=7)	Kentucky	4	57.1	
	Newport	15	13.4						Heidelberg	3	42.9	
	I 4,[5],12:i:-	5	4.5		Ground Turkey (N=1)	Infantis	1	100.0	Turkeys (N=4)	Agona	3	75.0
	Heidelberg	3	2.7							Derby	1	25.0
	Agona	2	1.8	Ground Beef (N=2)		Dublin	2	100.0	Cattle (N=30)	Typhimurium	12	40.0
	Bardo	2	1.8							Newport	8	26.7
	Dublin	2	1.8							Dublin	5	16.7
	Infantis	2	1.8							Rough O:g.p:-	2	6.7
	Paratyphi B Var. L(+) Tartrate	2	1.8							Agona	1	3.3
	Cerro	1	0.9					Give		1	3.3	
	Mississippi	1	0.9				Montevideo	1		3.3		
	Saintpaul	1	0.9	Pork Chops (N=1)	Typhimurium	1	100.0	Swine (N=16)	Typhimurium	14	87.5	
	Unknown serotype	1	0.9						Agona	2	12.5	
	Partially Serotyped	2	1.8									
	Rough/Nomotile isolates	1	0.9									

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, 2009

Humans				Retail Meats				Food Animals				
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%	
Humans (N=15)	Typhimurium	8	53.3	Chicken Breasts (N=0)				Chickens (N=0)				
	Heidelberg	3	20.0									
	Bardo	2	13.3									
	Agona	1	6.7									
	Newport	1	6.7	Ground Turkey (N=0)				Turkeys (N=1)	Agona	1	100.0	
				Ground Beef (N=0)				Cattle (n=3)	Agona	1	33.3	
									Give	1	33.3	
								Typhimurium	1	33.3		
				Pork Chops (N=1)	Typhimurium	1	100.0	Swine (N=2)	Agona	1	50.0	
								Derby	1	50.0		

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

Table 28. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are at least ACSSuTAuCx¹ Resistant, by Serotype, 2009

Humans				Retail Meats				Food Animals				
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%	
Humans (N=30)	Newport	15	50.0	Chicken Breasts (N=0)				Chickens (N=7)	Kentucky	4	57.1	
	Typhimurium	6	20.0						Heidelberg	3	42.9	
	Agona	2	6.7									
	Bardo	2	6.7									
	Infantis	2	6.7	Ground Turkey (N=1)	Infantis	1	100.0	Turkeys (N=4)	Agona	3	75.0	
	Dublin	1	3.3			Derby	1		25.0			
	Heidelberg	1	3.3	Ground Beef (N=2)	Dublin	2	100.0	Cattle (N=19)	Newport	8	42.1	
	Unknown serotype	1	3.3							Dublin	4	21.1
									Typhimurium	3	15.8	
									Agona	1	5.3	
								Give	1	5.3		
								Montevideo	1	5.3		
								Rough O:g.p:-	1	5.3		
				Pork Chops (N=0)				Swine (N=2)	Agona	2	100.0	

¹ ACSSuTAuCx = ACSSuT, amoxicillin-clavulanic acid, and ceftriaxone

Table 29. Non-Typhoidal *Salmonella* Isolates from Humans, Retail Meats, and Food Animals that are at least Ceftriaxone and Nalidixic Acid Resistant, by Serotype, 2009

Humans				Retail Meats				Food Animals				
Source	Serotype	n	%	Meat Type	Serotype	n	%	Animal Source	Serotype	n	%	
Humans (N=4)	Typhimurium	2	50.0	Chicken Breasts (N=0)				Chickens (N=0)				
	Javiana	1	25.0									
	Unknown serotype	1	25.0									
				Ground Turkey (N=0)				Turkeys (N=0)				
				Ground Beef (N=2)	Dublin	2	100.0	Cattle (N=0)				
				Pork Chops (N=0)				Swine (N=0)				

E. Antimicrobial Susceptibility among *Salmonella* serotype Enteritidis

Table 30a. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	244	269	319	277	337	257	271	384	413	385	439	410	
	Chicken Breasts					4	3	3	12	17	13	30	27	
	Ground Turkey					5	1	0	0	0	0	1	0	
	Ground Beef					1	1	0	0	0	0	1	0	
	Pork Chops					0	0	0	0	0	0	0	0	
	Chickens	13	41	31	21	48	42	84	173	188	124	116	118	
	Turkeys	0	1	1	0	0	0	0	0	3	0	1	0	
	Cattle	1	8	4	4	6	3	2	2	2	4	5	0	
	Swine	0	2	1	1	1	1	1	1	0	1	0	0	
	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%	0.0%	0.0%	0.0%	0.0%	
		Ground Turkey					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%	0.0%	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
		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
		Gentamicin (MIC ≥ 16 µg/ml)	Humans	0.4%	0.0%	0.3%	0.0%	0.3%	0.4%	0.4%	0.8%	0.2%	0.0%	0.2%
	Chicken Breasts	1	0	1	0	1	1	1	3	1	0	1	0	
	Ground Turkey					0.0%	0.0%					0.0%	0.0%	
	Ground Beef					0	0					0.0%	0.0%	
	Pork Chops					0	0					0	0	
	Chickens	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	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	
	Cattle	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
	Swine	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
	Kanamycin (MIC ≥ 64 µg/ml)	Humans	0.4%	0.4%	0.3%	0.7%	0.3%	0.0%	0.7%	0.3%	0.2%	0.5%	0.0%	0.2%
	Chicken Breasts	1	1	1	2	1	0	2	1	1	2	0	1	
	Ground Turkey					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	0	
	Chickens	0.0%	0.0%	0.0%	0.0%	2.1%	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	
	Cattle	0.0%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	
	Swine	0	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0	0.0%	0	0	
	Streptomycin (MIC ≥ 64 µg/ml)	Humans	1.6%	2.2%	0.0%	1.4%	1.5%	1.2%	2.2%	1.0%	1.2%	0.5%	0.5%	1.2%
	Chicken Breasts	4	6	0	4	5	3	6	4	5	2	2	5	
	Ground Turkey					0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	0.0%	
	Ground Beef					0	0					1	0	
	Pork Chops					0	0					0	0	
	Chickens	0.0%	0.0%	0.0%	0.0%	2.1%	0.0%	1.2%	0.6%	0.0%	0.8%	0.0%	0.0%	
	Turkeys	0	0.0%	0.0%	0	1	0	1	1	0	1	0	0	
	Cattle	0.0%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	
	Swine	0	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	1	0	0	0	

Table 30b. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	244	269	319	277	337	257	271	384	413	385	439	410	
	Chicken Breasts					4	3	3	12	17	13	30	27	
	Ground Turkey					5	1	0	0	0	0	1	0	
	Ground Beef					1	1	0	0	0	0	1	0	
	Pork Chops					0	0	0	0	0	0	0	0	
	Chickens	13	41	31	21	48	42	84	173	188	124	116	118	
	Turkeys	0	1	1	0	0	0	0	0	3	0	1	0	
	Cattle	1	8	4	4	6	3	2	2	2	4	5	0	
	Swine	0	2	1	1	1	1	1	1	0	0	1	0	
	Antimicrobial Class	Antimicrobial (Resistance Breakpoint)												
		Isolate Source												
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC \geq 32 / 16 μ g/ml)	Humans	0.0% 0	0.4% 1	0.0% 0	1.4% 4	0.6% 2	0.0% 0	0.0% 0	0.8% 3	0.5% 2	0.5% 2	0.0% 0	0.0% 0
		Chicken Breasts					0.0% 0	33.3% 1	33.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.7% 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	2.4% 1	3.2% 1	0.0% 0	4.2% 2	0.0% 0	1.2% 1	0.6% 1	0.0% 0	0.0% 0	0.9% 1	0.8% 1
		Turkeys	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		
		Cephems	Cefoxitin (MIC \geq 32 μ g/ml)	Humans			0.0% 0	0.4% 1	0.0% 0	0.0% 0	0.0% 0	1.0% 4	0.5% 2	0.3% 1
Chicken Breasts							0.0% 0	33.3% 1	33.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.7% 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	2.1% 1	0.0% 0	1.2% 1	0.6% 1	0.0% 0	0.0% 0	0.9% 1	0.0% 0
Turkeys					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	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		
Ceftiofur (MIC \geq 8 μ g/ml)	Humans			0.0% 0	0.4% 1	0.0% 0	2.2% 6	0.0% 0	0.0% 0	0.0% 0	0.5% 2	0.5% 2	0.3% 1	0.0% 0
	Chicken Breasts						0.0% 0	33.3% 1	33.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.7% 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	4.9% 2	3.2% 1	0.0% 0	4.2% 2	0.0% 0	1.2% 1	1.2% 2	0.0% 0	0.0% 0	0.9% 1	0.8% 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	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		
	Ceftriaxone (MIC \geq 4 μ g/ml)		Humans	0.0% 0	0.4% 1	0.0% 0	1.4% 4	0.0% 0	0.0% 0	0.0% 0	0.3% 1	0.5% 2	0.3% 1	0.0% 0
Chicken Breasts							0.0% 0	33.3% 1	33.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.7% 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	2.4% 1	3.2% 1	0.0% 0	4.2% 2	0.0% 0	1.2% 1	0.6% 1	0.0% 0	0.0% 0	0.9% 1	0.8% 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	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			

Table 30c. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	244	269	319	277	337	257	271	384	413	385	439	410	
	Chicken Breasts					4	3	3	12	17	13	30	27	
	Ground Turkey					5	1	0	0	0	0	1	0	
	Ground Beef					1	1	0	0	0	0	1	0	
	Pork Chops					0	0	0	0	0	0	0	0	
	Chickens	13	41	31	21	48	42	84	173	188	124	116	118	
	Turkeys	0	1	1	0	0	0	0	0	3	0	1	0	
	Cattle	1	8	4	4	6	3	2	2	2	4	5	0	
	Swine	0	2	1	1	1	1	1	1	0	0	1	0	
	Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source											
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole ¹ (MIC ≥ 512 µg/ml)	Humans	2.0% 5	3.0% 8	0.9% 3	2.2% 6	1.5% 5	1.2% 3	1.8% 5	1.6% 6	1.5% 6	1.6% 6	1.1% 5	1.7% 7
		Chicken Breasts					0.0% 0	0.0% 0	33.3% 1	0.0% 0	0.0% 0	0.0% 0	3.3% 1	3.7% 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	4.9% 2	3.2% 1	0.0% 0	4.2% 2	2.4% 1	1.2% 1	0.0% 0	0.0% 0	0.8% 1	0.9% 1	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	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		
		Penicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	0.8% 2	0.7% 2	0.0% 0	0.7% 2	0.6% 2	0.8% 2	0.0% 0	0.5% 2	0.5% 2	1.0% 4
Chicken Breasts							0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.7% 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	0.0% 0	0.0% 0	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	
Swine				0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0			0.0% 0		
Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)			Humans	6.1% 15	10.8% 29	7.5% 24	8.7% 24	6.8% 23	2.3% 6	4.1% 11	2.9% 11	4.4% 18	2.1% 8
		Chicken Breasts					0.0% 0	66.7% 2	33.3% 1	0.0% 0	17.6% 3	0.0% 0	6.7% 2	18.5% 5
		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	30.8% 4	12.2% 5	9.7% 3	0.0% 0	4.2% 2	0.0% 0	1.2% 1	1.2% 2	1.6% 3	1.6% 2	2.6% 3	2.5% 3
		Turkeys		0.0% 0	0.0% 0						0.0% 0		0.0% 0	
		Cattle	100.0% 1	12.5% 1	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	100.0% 1	0.0% 0	0.0% 0	0.0% 0			0.0% 0		

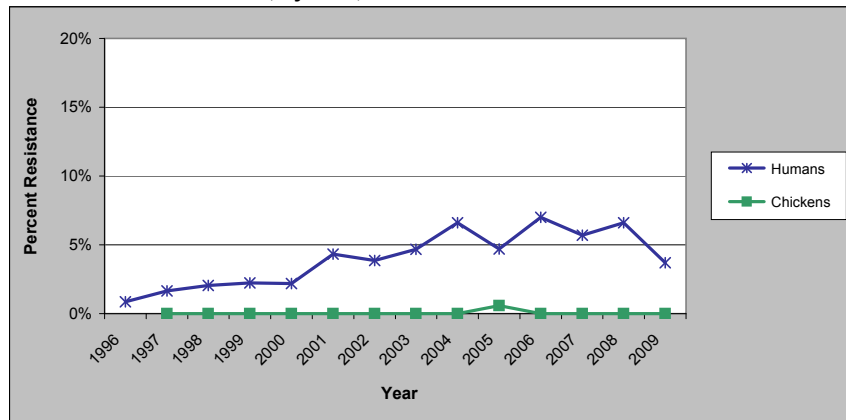
¹ Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

Table 30d. Antimicrobial Resistance among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	244	269	319	277	337	257	271	384	413	385	439	410	
	Chicken Breasts					4	3	3	12	17	13	30	27	
	Ground Turkey					5	1	0	0	0	0	1	0	
	Ground Beef					1	1	0	0	0	0	1	0	
	Pork Chops					0	0	0	0	0	0	0	0	
	Chickens	13	41	31	21	48	42	84	173	188	124	116	118	
	Turkeys	0	1	1	0	0	0	0	0	3	0	1	0	
	Cattle	1	8	4	4	6	3	2	2	2	4	5	0	
	Swine	0	2	1	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	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	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	3.7% 15
		Chicken Breasts					0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.7% 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	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	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	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	1.2% 5
		Chicken Breasts					0.0% 0	0.0% 0	33.3% 1	0.0% 0	11.8% 2	0.0% 0	3.3% 1	3.7% 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	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	2.5% 3
		Turkeys		0.0% 0	0.0% 0						0.0% 0		0.0% 0	
		Cattle	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, 1996-2009¹



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, 1996-2009

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	351	301	244	269	319	277	337	257	271	384	413	385	439	410
Chicken Breasts							4	3	3	12	17	13	30	27
Ground Turkey							5	1	0	0	0	0	1	0
Ground Beef							1	1	0	0	0	0	1	0
Pork Chops							0	0	0	0	0	0	0	0
Chickens		1	13	41	31	21	48	42	84	173	188	124	116	118
Turkeys		0	0	1	1	0	0	0	0	0	3	0	1	0
Cattle		1	1	8	4	4	6	3	2	2	2	4	5	0
Swine		0	0	2	1	1	1	1	1	0	0	1	0	0

Multidrug Resistance

Table 32a. Resistance Patterns among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	244	269	319	277	337	257	271	384	413	385	439	410
	Chicken Breasts					4	3	3	12	17	13	30	27
	Ground Turkey					5	1	0	0	0	0	1	0
	Ground Beef					1	1	0	0	0	0	1	0
	Pork Chops					0	0	0	0	0	0	0	0
	Chickens	13	41	31	21	48	42	84	173	188	124	116	118
	Turkeys	0	1	1	0	0	0	0	0	3	0	1	0
	Cattle	1	8	4	4	6	3	2	2	2	4	5	0
	Swine	0	2	1	1	1	1	1	0	0	1	0	0
Resistance Pattern	Isolate Source												
1. No Resistance Detected	Humans	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	92.0% 377
	Chicken Breasts					100.0% 4	33.3% 1	66.7% 2	100.0% 12	82.4% 14	100.0% 13	90.0% 27	74.1% 20
	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	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	96.6% 114
	Turkeys		100.0% 1	100.0% 1						100.0% 3		100.0% 1	
	Cattle	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	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	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	0.2% 1	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	3.7% 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	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	0.8% 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	50.0% 1	0.0% 0	0.0% 0	
	Swine	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	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	0.0% 0	0.5% 2
	Chicken Breasts					0.0% 0	0.0% 0	33.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.7% 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	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	0.8% 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	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		
4. Resistant to ≥ 5 Antimicrobial Classes	Humans	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	0.0% 0	0.2% 1
	Chicken Breasts					0.0% 0	0.0% 0	33.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	3.7% 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	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	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	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		

Table 32b. Resistance Patterns among *Salmonella* Enteritidis Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	244	269	319	277	337	257	271	384	413	385	439	410
	Chicken Breasts					4	3	3	12	17	13	30	27
	Ground Turkey					5	1	0	0	0	0	1	0
	Ground Beef					1	1	0	0	0	0	1	0
	Pork Chops					0	0	0	0	0	0	0	0
	Chickens	13	41	31	21	48	42	84	173	188	124	116	118
	Turkeys	0	1	1	0	0	0	0	0	3	0	1	0
	Cattle	1	8	4	4	6	3	2	2	2	4	5	0
	Swine	0	2	1	1	1	1	1	0	0	1	0	0
Resistance Pattern	Isolate Source												
5. At Least ACSSuT¹ Resistant	Humans	0.0% 0	0.4% 1	0.0% 0	0.0% 0	0.0% 0	0.4% 1	0.4% 1	0.5% 2	0.0% 0	0.3% 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	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	
	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		
6. At Least ACT/S² Resistant	Humans	0.0% 0	0.4% 1	0.0% 0	0.0% 0	0.0% 0	0.4% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	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	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	
	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		
7. At Least ACSSuTAuCx³ Resistant	Humans	0.0% 0	0.4% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.3% 1	0.0% 0	0.3% 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	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	
	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		
8. At Least Ceftriaxone 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	0.3% 1	0.0% 0	0.3% 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	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	
	Swine	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0			0.0% 0		

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

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

³ ACSSuTAuCx = ACSSuT, amoxicillin-clavulanic acid, and ceftriaxone

F. Antimicrobial Susceptibility among *Salmonella* serotype Typhimurium

Table 33a. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	381	363	304	325	394	408	383	438	409	404	397	371	
	Chicken Breasts					9	22	49	29	21	25	68	123	
	Ground Turkey					2	2	2	1	0	1	3	1	
	Ground Beef					2	1	0	0	1	3	2	0	
	Pork Chops					2	1	2	2	2	3	3	1	
	Chickens	66	154	145	130	150	156	171	183	105	83	70	36	
	Turkeys	6	37	18	15	9	6	14	7	5	6	3	2	
	Cattle	33	189	187	87	98	78	48	34	22	26	28	18	
	Swine	104	114	81	44	48	27	53	42	25	44	10	20	
	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%	0.0%	
		Ground Beef					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%	
		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%	2.3%	0.0%	0.0%
	Gentamicin (MIC ≥ 16 µg/ml)	Humans	3.7%	2.2%	2.6%	1.5%	2.3%	2.0%	2.1%	1.8%	2.7%	2.5%	1.5%	1.9%
		Chicken Breasts	14	8	8	5	9	8	8	8	11	10	6	7
		Ground Turkey					0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	33.3%	0.0%
		Ground Beef					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%	50.0%	0.0%	0.0%	0.0%
		Chickens	18.5%	16.9%	15.2%	3.1%	12.7%	5.1%	4.1%	4.4%	6.7%	3.6%	5.7%	0.0%
		Turkeys	50.0%	29.7%	33.3%	53.3%	44.4%	83.3%	64.3%	14.3%	20.0%	16.7%	33.3%	50.0%
		Cattle	3.0%	2.6%	1.6%	0.0%	2.0%	1.3%	0.0%	0.0%	0.0%	7.7%	0.0%	0.0%
		Swine	0.0%	1.8%	0.0%	2.3%	2.1%	0.0%	3.8%	7.1%	8.0%	2.3%	10.0%	0.0%
	Kanamycin (MIC ≥ 64 µg/ml)	Humans	15.7%	12.9%	13.2%	8.3%	7.6%	7.1%	5.7%	5.7%	5.1%	5.9%	2.3%	4.9%
		Chicken Breasts	60	47	40	27	30	29	22	25	21	24	9	18
		Ground Turkey					0.0%	18.2%	34.7%	24.1%	47.6%	12.0%	25.0%	27.6%
		Ground Beef					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%	100.0%	0.0%	0.0%	0.0%
		Chickens	4.6%	3.9%	3.4%	3.1%	5.3%	7.7%	9.9%	7.7%	18.1%	7.2%	8.6%	8.3%
		Turkeys	66.7%	59.5%	44.4%	73.3%	55.6%	50.0%	21.4%	0.0%	0.0%	16.7%	0.0%	0.0%
		Cattle	54.5%	36.5%	27.3%	24.1%	26.5%	16.7%	14.6%	38.2%	13.6%	26.9%	14.3%	33.3%
		Swine	18.3%	21.1%	14.8%	13.6%	2.1%	0.0%	9.4%	7.1%	16.0%	9.1%	10.0%	0.0%
	Streptomycin (MIC ≥ 64 µg/ml)	Humans	47.8%	43.3%	39.5%	40.0%	32.0%	35.5%	31.9%	28.1%	29.3%	32.4%	28.5%	25.9%
		Chicken Breasts	182	157	120	130	126	145	122	123	120	131	113	96
		Ground Turkey					0.0%	18.2%	14.3%	3.4%	9.5%	28.0%	16.2%	15.5%
		Ground Beef					0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	50.0%	0.0%
		Pork Chops					50.0%	100.0%	100.0%	100.0%	100.0%	0.0%	33.3%	100.0%
		Chickens	44.6%	40.9%	35.9%	16.9%	30.0%	16.7%	8.2%	13.7%	17.1%	10.8%	5.7%	5.6%
		Turkeys	83.3%	81.1%	72.2%	93.3%	77.8%	100.0%	64.3%	57.1%	60.0%	50.0%	33.3%	100.0%
		Cattle	57.6%	63.0%	63.1%	46.0%	66.3%	52.6%	56.3%	55.9%	54.5%	50.0%	50.0%	72.2%
		Swine	82.7%	80.7%	77.8%	70.5%	77.1%	59.3%	77.4%	69.0%	72.0%	59.1%	80.0%	80.0%

Table 33b. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year			1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans		381	363	304	325	394	408	383	438	409	404	397	371	
	Chicken Breasts						9	22	49	29	21	25	68	123	
	Ground Turkey						2	2	2	1	0	1	3	1	
	Ground Beef						2	1	0	0	1	3	2	0	
	Pork Chops						2	1	2	2	2	3	3	1	
	Chickens	66	154	145	130	150	156	171	183	105	83	70	36		
	Turkeys	6	37	18	15	9	6	14	7	5	6	3	2		
	Cattle	33	189	187	87	98	78	48	34	22	26	28	18		
Swine	104	114	81	44	48	27	53	42	25	44	10	20			
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source													
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Humans	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	6.7% 27	3.3% 13	6.2% 23	
		Chicken Breasts					33.3% 3	63.6% 14	49.0% 24	51.7% 15	57.1% 12	44.0% 11	50.0% 34	57.7% 71	
		Ground Turkey					0.0% 0	100.0% 2	0.0% 0	100.0% 1		0.0% 0	33.3% 1	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	0.0% 0	
		Chickens	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	33.3% 12	
		Turkeys	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	50.0% 1	
		Cattle	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	27.8% 5	
		Swine	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	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	5.7% 23	3.3% 13	5.4% 20	
		Chicken Breasts					33.3% 3	63.6% 14	49.0% 24	51.7% 15	52.4% 11	40.0% 10	47.1% 32	47.2% 58	
		Ground Turkey					0.0% 0	100.0% 2	0.0% 0	100.0% 1		0.0% 0	33.3% 1	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	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	27.8% 10	
		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	50.0% 1	
		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	22.2% 4	
		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	0.0% 0	
	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	1.8% 7	1.9% 7	3.6% 11	3.1% 10	4.3% 17	4.9% 20	4.4% 17	2.5% 11	4.2% 17	6.4% 26	3.3% 13	6.5% 24	
		Chicken Breasts					33.3% 3	63.6% 14	49.0% 24	51.7% 15	57.1% 12	44.0% 11	50.0% 34	56.9% 70	
		Ground Turkey					0.0% 0	100.0% 2	0.0% 0	100.0% 1		0.0% 0	33.3% 1	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	0.0% 0	
		Chickens	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	33.3% 12	
		Turkeys	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	50.0% 1	
		Cattle	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	27.8% 5	
		Swine	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	0.0% 0	
	Ceftriaxone (MIC ≥ 4 µg/ml)	Humans	1.8% 7	1.9% 7	3.3% 10	3.1% 10	4.3% 17	4.9% 20	4.4% 17	2.5% 11	4.2% 17	6.4% 26	3.3% 13	6.5% 24	
		Chicken Breasts					33.3% 3	63.6% 14	49.0% 24	51.7% 15	57.1% 12	44.0% 11	50.0% 34	57.7% 71	
		Ground Turkey					0.0% 0	100.0% 2	0.0% 0	100.0% 1		0.0% 0	33.3% 1	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	0.0% 0	
		Chickens	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	33.3% 12	
Turkeys		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	50.1% 1		
Cattle		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	27.8% 5		
Swine		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	0.0% 0		

Table 33c. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009			
Number of Isolates Tested	Humans	381	363	304	325	394	408	383	438	409	404	397	371			
	Chicken Breasts					9	22	49	29	21	25	68	123			
	Ground Turkey					2	2	2	1	0	1	3	1			
	Ground Beef					2	1	0	0	1	3	2	0			
	Pork Chops					2	1	2	2	2	3	3	1			
	Chickens	66	154	145	130	150	156	171	183	105	83	70	36			
	Turkeys	6	37	18	15	9	6	14	7	5	6	3	2			
	Cattle	33	189	187	87	98	78	48	34	22	26	28	18			
	Swine	104	114	81	44	48	27	53	42	25	44	10	20			
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source														
Folate Pathway Inhibitors	Sulfamethoxazole/Sulfisoxazole ¹ (MIC ≥ 512 µg/ml)	Humans	50.1% 191	45.7% 166	45.4% 138	43.1% 140	32.2% 127	38.7% 158	36.0% 138	32.0% 140	33.3% 136	37.4% 151	30.2% 120	29.9% 111		
		Chicken Breasts					44.4% 4	31.8% 7	73.5% 36	69.0% 20	90.5% 19	68.0% 17	95.6% 65	96.8% 119		
		Ground Turkey					0.0% 0	50.0% 1	100.0% 2	0.0% 0		100.0% 1	66.7% 2	100.0% 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	100.0% 1		
		Chickens	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	52.8% 19		
		Turkeys	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	100.0% 2		
		Cattle	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	83.3% 15		
		Swine	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	90.0% 18		
	Trimethoprim-Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	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	2.5% 10	1.8% 7	3.0% 11		
		Chicken Breasts					0.0% 0	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			
		Pork Chops					0.0% 0	0.0% 0	0.0% 0	50.0% 1	0.0% 0	0.0% 0	0.0% 0	100.0% 1		
		Chickens	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	2.8% 1		
		Turkeys	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	0.0% 0		
		Cattle	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	5.6% 1		
		Swine	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	5.0% 1		
		Penicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	45.7% 174	41.3% 150	42.1% 128	42.5% 138	33.8% 133	36.3% 148	32.1% 123	29.0% 127	28.1% 115	31.7% 128	26.2% 104	28.0% 104
				Chicken Breasts					33.3% 3	72.7% 16	53.1% 26	55.2% 16	57.1% 12	48.0% 12	61.8% 42	68.3% 84
Ground Turkey							0.0% 0	100.0% 2	50.0% 1	100.0% 1		100.0% 1	33.3% 1	0.0% 0		
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	100.0% 1		
Chickens	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	33.3% 12		
Turkeys	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	50.0% 1		
Cattle	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	83.3% 15		
Swine	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	80.0% 16		
Phenicols	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	34.1% 130	28.9% 105	30.9% 94	31.7% 103	23.4% 92	28.2% 115	24.3% 93	24.4% 107	22.0% 90	25.5% 103	23.2% 92	20.5% 76		
		Chicken Breasts					0.0% 0	9.1% 2	4.1% 2	3.4% 1	0.0% 0	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	0.0% 0		
		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	100.0% 1		
		Chickens	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	0.0% 0		
		Turkeys	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	0.0% 0		
		Cattle	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	66.7% 12		
		Swine	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% 23	65.9% 29	50.0% 5	75.0% 15		

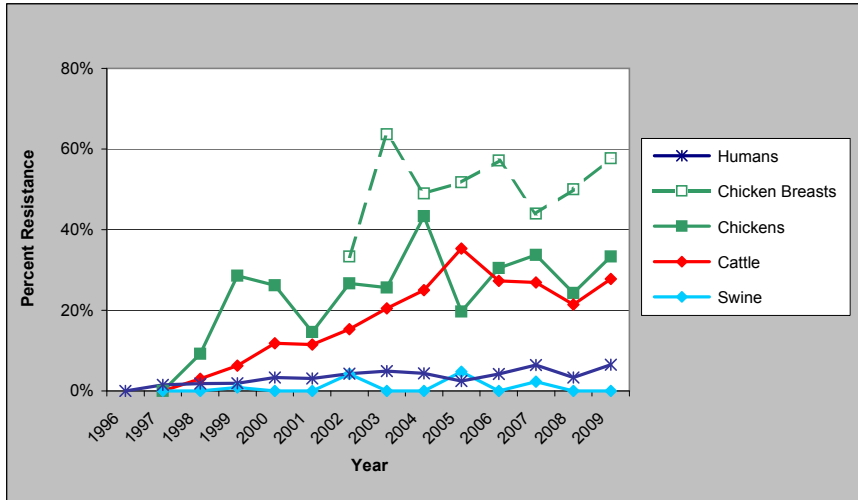
¹ Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

Table 33d. Antimicrobial Resistance among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year			1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		
Number of Isolates Tested	Humans		381	363	304	325	394	408	383	438	409	404	397	371		
	Chicken Breasts						9	22	49	29	21	25	68	123		
	Ground Turkey						2	2	2	1	0	1	3	1		
	Ground Beef						2	1	0	0	1	3	2	0		
	Pork Chops						2	1	2	2	2	3	3	1		
	Chickens		66	154	145	130	150	156	171	183	105	83	70	36		
	Turkeys		6	37	18	15	9	6	14	7	5	6	3	2		
	Cattle		33	189	187	87	98	78	48	34	22	26	28	18		
	Swine		104	114	81	44	48	27	53	42	25	44	10	20		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source														
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	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	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	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			
		Pork Chops					0.0% 0	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	0.5% 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	2.2% 8		
		Chicken Breasts					0.0% 0	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	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	0.0% 0		
		Chickens	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	0.0% 0		
		Turkeys	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	0.0% 0		
		Cattle	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	0.0% 0		
		Swine	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	0.0% 0		
		Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans	46.5% 177	41.9% 152	43.4% 132	43.4% 141	32.0% 126	38.2% 156	30.3% 116	30.4% 133	31.5% 129	36.9% 149	27.5% 109	28.8% 107
				Chicken Breasts					44.4% 4	31.8% 7	71.4% 35	69.0% 20	90.5% 19	72.0% 18	94.1% 64	95.9% 118
Ground Turkey							0.0% 0	50.0% 1	100.0% 2	0.0% 0		100.0% 1	66.7% 2	100.0% 1		
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	100.0% 1		
Chickens	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	55.6% 20		
Turkeys	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% 4	50.0% 2		
Cattle	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	88.9% 16		
Swine	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	100.0% 20		

Ceftriaxone Resistance

Figure 13. Percent of *Salmonella* Typhimurium Isolates from Humans, Retail Chicken Breasts, and Food Animals Resistant to Ceftriaxone by Year, 1996-2009¹



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, 1996-2009

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	307	328	381	363	304	325	394	408	383	438	409	404	397	371
Chicken Breasts							9	22	49	29	21	25	68	123
Ground Turkey							2	2	2	1	0	1	3	1
Ground Beef							2	1	0	0	1	3	2	0
Pork Chops							2	1	2	2	2	3	3	1
Chickens		24	66	154	145	130	150	156	171	183	105	83	70	36
Turkeys		4	6	37	18	15	9	6	14	7	5	6	3	2
Cattle		1	33	189	187	87	98	78	48	34	22	26	28	18
Swine		25	104	114	81	44	48	27	53	42	25	44	10	20

Multidrug Resistance

Table 35a. Resistance Patterns among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	381	363	304	325	394	408	383	438	409	404	397	371
	Chicken Breasts					9	22	49	29	21	25	68	123
	Ground Turkey					2	2	2	1	0	1	3	1
	Ground Beef					2	1	0	0	1	3	2	0
	Pork Chops					2	1	2	2	2	3	3	1
	Chickens	66	154	145	130	150	156	171	183	105	83	70	36
	Turkeys	6	37	18	15	9	6	14	7	5	6	3	2
	Cattle	33	189	187	87	98	78	48	34	22	26	28	18
	Swine	104	114	81	44	48	27	53	42	25	44	10	20
Resistance Pattern	Isolate Source												
1. No Resistance Detected	Humans	46.5% 177	50.4% 183	49.3% 150	49.2% 160	59.9% 236	54.7% 223	60.6% 232	65.1% 285	62.6% 256	57.4% 232	68.0% 270	63.6% 236
	Chicken Breasts					22.2% 2	22.7% 5	14.3% 7	24.1% 7	0.0% 0	24.0% 6	4.4% 3	2.4% 3
	Ground Turkey					100.0% 2	0.0% 0	0.0% 0	0.0% 0		0.0% 0	33.3% 1	0.0% 0
	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	0.0% 0
	Chickens	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	33.3% 12
	Turkeys	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	0.0% 0
	Cattle	36.4% 12	29.1% 55	26.7% 50	34.5% 30	19.4% 19	39.7% 31	35.4% 17	26.5% 9	31.8% 7	34.6% 9	46.4% 13	5.5% 1
	Swine	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	0.0% 0
2. Resistant to ≥ 3 Antimicrobial Classes	Humans	46.7% 178	43.0% 156	43.4% 132	41.5% 135	32.5% 128	37.3% 152	31.6% 121	30.1% 132	30.3% 124	34.4% 139	27.7% 110	28.0% 104
	Chicken Breasts					33.3% 3	72.7% 16	71.4% 35	58.6% 17	81.0% 17	68.0% 17	79.4% 54	75.6% 93
	Ground Turkey					0.0% 0	100.0% 2	100.0% 2	100.0% 1		100.0% 1	33.3% 1	0.0% 0
	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	100.0% 1
	Chickens	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	38.9% 14
	Turkeys	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	50.0% 1
	Cattle	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	83.3% 15
	Swine	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	85.0% 17
3. Resistant to ≥ 4 Antimicrobial Classes	Humans	43.3% 165	38.6% 140	39.8% 121	37.8% 123	28.4% 112	32.4% 132	27.7% 106	27.4% 120	26.9% 110	30.0% 121	24.7% 98	24.0% 89
	Chicken Breasts					0.0% 0	36.4% 8	46.9% 23	48.3% 14	47.6% 10	40.0% 10	55.9% 38	61.0% 75
	Ground Turkey					0.0% 0	50.0% 1	50.0% 1	0.0% 0		100.0% 1	33.3% 1	0.0% 0
	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	100.0% 1
	Chickens	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	25.0% 9
	Turkeys	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	50.0% 1
	Cattle	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	77.8% 14
	Swine	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	75.0% 15
4. Resistant to ≥ 5 Antimicrobial Classes	Humans	34.1% 130	28.1% 102	29.6% 90	29.5% 96	23.1% 91	27.7% 113	24.3% 93	22.8% 100	20.8% 85	25.0% 101	23.7% 94	22.1% 82
	Chicken Breasts					0.0% 0	27.3% 6	44.9% 22	48.3% 14	47.6% 10	40.0% 10	48.5% 33	56.9% 70
	Ground Turkey					0.0% 0	50.0% 1	50.0% 1	0.0% 0		100.0% 1	33.3% 1	0.0% 0
	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	100.0% 1
	Chickens	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	25.9% 9
	Turkeys	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	50.0% 1
	Cattle	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	72.2% 13
	Swine	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	70.0% 14

Table 35b. Resistance Patterns among *Salmonella* Typhimurium Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	381	363	304	325	394	408	383	438	409	404	397	371
	Chicken Breasts					9	22	49	29	21	25	68	123
	Ground Turkey					2	2	2	1	0	1	3	1
	Ground Beef					2	1	0	0	1	3	2	0
	Pork Chops					2	1	2	2	2	3	3	1
	Chickens	66	154	145	130	150	156	171	183	105	83	70	36
	Turkeys	6	37	18	15	9	6	14	7	5	6	3	2
	Cattle	33	189	187	87	98	78	48	34	22	26	28	18
	Swine	104	114	81	44	48	27	53	42	25	44	10	20
Resistance Pattern	Isolate Source												
5. At Least ACSSuT¹ Resistant	Humans	32.5% 124	27.8% 101	28.0% 85	29.5% 96	21.6% 85	26.5% 108	23.5% 90	22.4% 98	19.6% 80	22.8% 92	22.9% 91	19.4% 72
	Chicken Breasts					0.0% 0	9.1% 2	4.1% 2	3.5% 1	0.0% 0	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	0.0% 0
	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	100.0% 1
	Chickens	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	0.0% 0
	Turkeys	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	0.0% 0
	Cattle	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	66.7% 12
	Swine	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	70.0% 14
6. At Least ACT/S² Resistant	Humans	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	2.0% 8	0.5% 2	2.2% 8
	Chicken Breasts					0.0% 0	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	
	Pork Chops					0.0% 0	0.0% 0	0.0% 0	50.0% 1	0.0% 0	0.0% 0	0.0% 0	100.0% 1
	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	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	5.6% 1
	Swine	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	0.0% 0
7. At Least ACSSuTAuCx³ Resistant	Humans	1.0% 4	0.6% 2	1.6% 5	1.2% 4	1.8% 7	2.2% 9	2.6% 10	1.8% 8	2.9% 12	3.7% 15	2.0% 8	1.6% 6
	Chicken Breasts					0.0% 0	0.0% 0	4.1% 2	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	33.3% 1	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	0.0% 0
	Chickens	0.0% 0	0.0% 0	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	0.0% 0
	Turkeys	0.0% 0	45.9% 17	33.3% 6	53.3% 8	11.1% 1	16.7% 1	14.2% 2	0.0% 0	0.0% 0	16.7% 1	0.0% 0	0.0% 0
	Cattle	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	16.7% 3
	Swine	0.0% 0	0.9% 1	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	0.0% 0
8. At Least Ceftriaxone and Nalidixic Acid Resistant	Humans	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	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	0.0% 0
	Ground Turkey					0.0% 0	50.0% 1	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	0.0% 0
	Chickens	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	0.0% 0
	Turkeys	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	0.0% 0
	Cattle	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	0.0% 0
	Swine	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	0.0% 0

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

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

³ ACSSuTAuCx = ACSSuT, amoxicillin-clavulanic acid, and ceftriaxone

G. Antimicrobial Susceptibility among *Salmonella* serotype Newport

Table 36a. Antimicrobial Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	77	99	121	124	241	223	191	207	217	221	253	236	
	Chicken Breasts					0	0	0	0	0	0	0	1	
	Ground Turkey					3	2	2	3	0	0	3	3	
	Ground Beef					3	1	2	0	0	0	3	2	
	Pork Chops					2	1	0	0	0	0	0	0	
	Chickens	1	7	5	8	6	7	0	6	0	3	1	0	
	Turkeys	1	4	6	16	10	19	7	5	4	15	8	3	
	Cattle	8	54	109	87	113	75	44	27	30	30	31	17	
	Swine	1	5	2	7	0	3	0	1	1	1	2	0	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Aminoglycosides	Amikacin (MIC ≥ 64)	Humans	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Chicken Breasts												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						
		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	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	
	Gentamicin (MIC ≥ 16)	Humans	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	0.4% 1
		Chicken Breasts												0.0% 0
		Ground Turkey					0.0% 0	50.0% 1	0.0% 0	0.0% 0			33.3% 1	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						
		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	66.7% 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	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	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	3.6% 9	1.3% 3
		Chicken Breasts												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				33.3% 1	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		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	33.3% 1
		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	5.9% 1
		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	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	10.4% 23	14.2% 36	7.6% 18
		Chicken Breasts												0.0% 0
		Ground Turkey					33.3% 1	50.0% 1	0.0% 0	0.0% 0			33.3% 1	33.3% 1
		Ground Beef					66.7% 2	100.0% 1	100.0% 2				66.7% 2	0.0% 0
		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	66.7% 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	70.6% 12
		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, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	77	99	121	124	241	223	191	207	217	221	253	236	
	Chicken Breasts					0	0	0	0	0	0	0	1	
	Ground Turkey					3	2	2	3	0	0	3	3	
	Ground Beef					3	1	2	0	0	0	3	2	
	Pork Chops					2	1	0	0	0	0	0	0	
	Chickens	1	7	5	8	6	7	0	6	0	3	1	0	
	Turkeys	1	4	6	16	10	19	7	5	4	15	8	3	
	Cattle	8	54	109	87	113	75	44	27	30	30	31	17	
	Swine	1	5	2	7	0	3	0	1	1	1	2	0	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)													
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC \geq 32 / 16 μ g/ml)	Humans	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	8.1% 18	13.0% 33	6.8% 16
		Chicken Breasts												0.0% 0
		Ground Turkey					33.3% 1	0.0% 0	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	0.0% 0
		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	33.3% 1
		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	58.8% 10
		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 \geq 32 μ g/ml)	Humans			22.3% 27	25.8% 32	22.4% 54	21.5% 48	15.2% 29	12.6% 26	12.9% 28	8.1% 18	13.0% 33	5.9% 14
		Chicken Breasts												0.0% 0
		Ground Turkey					33.3% 1	0.0% 0	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	0.0% 0
		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	33.3% 1
		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	52.9% 6
		Swine			0.0% 0	85.7% 6		100.0% 3		0.0% 0	0.0% 0	0.0% 0	50.0% 1	
	Ceftiofur (MIC \geq 8 μ g/ml)	Humans	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	8.1% 18	13.0% 33	6.4% 15
		Chicken Breasts												0.0% 0
		Ground Turkey					33.3% 1	0.0% 0	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	0.0% 0
		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	33.3% 1
		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	58.8% 10
		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 \geq 4 μ g/ml)	Humans	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	8.1% 18	13.0% 33	6.4% 15
		Chicken Breasts												0.0% 0
		Ground Turkey					33.3% 1	0.0% 0	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	0.0% 0
		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	33.3% 1
		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	58.8% 10
		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 36c. Antimicrobial Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		
Number of Isolates Tested	Humans	77	99	121	124	241	223	191	207	217	221	253	236		
	Chicken Breasts					0	0	0	0	0	0	0	1		
	Ground Turkey					3	2	2	3	0	0	3	3		
	Ground Beef					3	1	2	0	0	0	3	2		
	Pork Chops					2	1	0	0	0	0	0	0		
	Chickens	1	7	5	8	6	7	0	6	0	3	1	0		
	Turkeys	1	4	6	16	10	19	7	5	4	15	8	3		
	Cattle	8	54	109	87	113	75	44	27	30	30	31	17		
	Swine	1	5	2	7	0	3	0	1	1	1	2	0		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source													
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole, (MIC ≥ 4 / 76 µg/ml)	Humans	3.9%	22.2%	23.1%	32.3%	25.7%	24.7%	16.8%	15.5%	15.2%	10.4%	13.8%	8.1%	
		Chicken Breasts	3	22	28	40	62	55	32	32	33	23	35	19	0.0%
		Ground Turkey					33.3%	50.0%	0.0%	0.0%			33.3%	33.3%	0
		Ground Beef					66.7%	100.0%	100.0%				66.7%	0.0%	1
		Pork Chops					100.0%	100.0%					2	0	0
		Chickens	100.0%	0.0%	0.0%	37.5%	0.0%	71.4%		50.0%		0.0%	100.0%		1
		Turkeys	0.0%	0.0%	16.7%	12.5%	0.0%	52.6%	14.3%	80.0%	75.0%	0.0%	37.5%	100.0%	3
		Cattle	12.5%	35.2%	73.4%	72.4%	74.3%	73.3%	77.3%	85.2%	83.3%	83.3%	74.2%	70.6%	12
		Swine	0.0%	0.0%	50.0%	85.7%		100.0%		0.0%	0.0%	0.0%	50.0%		0
	Trimethoprim- Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	1.3%	2.0%	4.1%	1.6%	4.1%	0.9%	2.1%	1.9%	3.2%	1.8%	3.2%	0.4%	
		Chicken Breasts	1	2	5	2	10	2	4	4	7	4	8	1	0.0%
		Ground Turkey					33.3%	0.0%	0.0%	0.0%			0.0%	0.0%	0
		Ground Beef					0.0%	0.0%	50.0%				0.0%	0.0%	0
		Pork Chops					100.0%	0.0%							0
		Chickens	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		16.7%		0.0%	100.0%		1
		Turkeys	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0
		Cattle	0.0%	1.9%	14.7%	12.6%	7.1%	0.0%	11.4%	25.9%	16.7%	13.3%	12.9%	0.0%	0
		Swine	0.0%	0.0%	0.0%	0.0%		33.3%		0.0%	0.0%	0.0%	0.0%	0.0%	0
Penicillins	Ampicillin (MIC ≥ 32 µg/ml)	Humans	2.6%	18.2%	23.1%	29.8%	24.9%	22.9%	15.7%	14.0%	15.2%	10.0%	15.0%	7.6%	
		Chicken Breasts	2	18	28	37	60	51	30	29	33	22	38	18	0.0%
		Ground Turkey					33.3%	0.0%	0.0%	0.0%			0.0%	0.0%	0
		Ground Beef					66.7%	100.0%	100.0%				66.7%	0.0%	0
		Pork Chops					100.0%	100.0%							0
		Chickens	100.0%	0.0%	0.0%	37.5%	16.7%	85.7%		50.0%		0.0%	100.0%		1
		Turkeys	0.0%	0.0%	0.0%	12.5%	0.0%	15.8%	28.6%	20.0%	75.0%	6.7%	25.0%	33.3%	1
		Cattle	12.5%	37.0%	77.1%	70.1%	78.8%	82.7%	81.8%	85.2%	80.0%	76.7%	74.2%	64.7%	11
		Swine	0.0%	0.0%	0.0%	85.7%		100.0%		0.0%	0.0%	0.0%	50.0%		0
Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	2.6%	18.2%	23.1%	28.2%	25.3%	22.4%	15.2%	13.5%	12.4%	9.5%	12.6%	6.8%	
		Chicken Breasts	2	18	28	35	61	50	29	28	27	21	32	16	0.0%
		Ground Turkey					33.3%	0.0%	0.0%	0.0%			0.0%	0.0%	0
		Ground Beef					66.7%	100.0%	100.0%				66.7%	0.0%	0
		Pork Chops					100.0%	100.0%							0
		Chickens	0.0%	0.0%	0.0%	37.5%	0.0%	85.7%		50.0%		0.0%	100.0%		1
		Turkeys	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
		Cattle	12.5%	37.0%	78.9%	73.6%	77.9%	78.7%	77.3%	81.5%	66.7%	76.7%	64.5%	52.9%	9
		Swine	0.0%	0.0%	50.0%	85.7%		100.0%		0.0%	0.0%	0.0%	50.0%		0

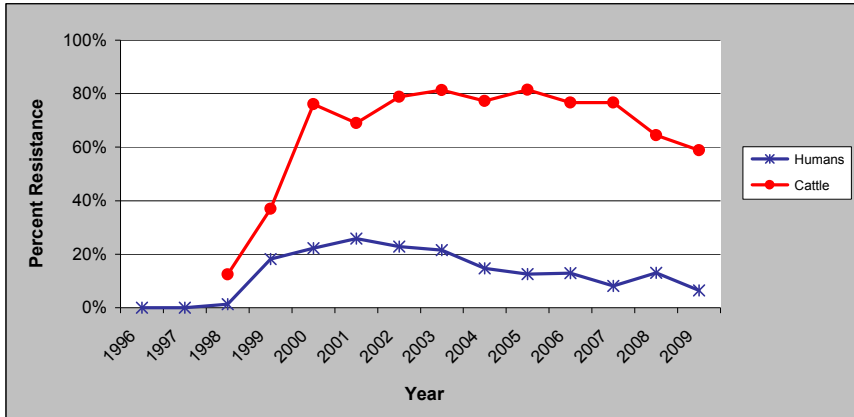
¹ Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

Table 36d. Antimicrobial Resistance among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	77	99	121	124	241	223	191	207	217	221	253	236	
	Chicken Breasts					0	0	0	0	0	0	0	1	
	Ground Turkey					3	2	2	3	0	0	3	3	
	Ground Beef					3	1	2	0	0	0	3	2	
	Pork Chops					2	1	0	0	0	0	0	0	
	Chickens	1	7	5	8	6	7	0	6	0	3	1	0	
	Turkeys	1	4	6	16	10	19	7	5	4	15	8	3	
	Cattle	8	54	109	87	113	75	44	27	30	30	31	17	
	Swine	1	5	2	7	0	3	0	1	1	1	2	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
		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						
		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	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	
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans	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	0.0% 0
		Chicken Breasts												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						
		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	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	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	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	10.0% 22	14.6% 37	8.1% 19
		Chicken Breasts												0.0% 0
		Ground Turkey					33.3% 1	0.0% 0	0.0% 0	0.0% 0			66.7% 2	0.0% 0
		Ground Beef					66.7% 2	100.0% 1	100.0% 2				66.7% 2	0.0% 0
		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	33.3% 1
		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	70.6% 12
		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, 1996-2009¹



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, 1996-2009

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	51	46	77	99	121	124	241	223	191	207	217	221	253	236
Chicken Breasts							0	0	0	0	0	0	0	1
Ground Turkey							3	2	2	3	0	0	3	3
Ground Beef							3	1	2	0	0	0	3	2
Pork Chops							2	1	0	0	0	0	0	0
Chickens		0	1	7	5	8	6	7	0	6	0	3	1	0
Turkeys		0	1	4	6	16	10	19	7	5	4	15	8	3
Cattle		0	8	54	109	87	113	75	44	27	30	30	31	17
Swine		0	1	5	2	7	0	3	0	1	1	1	2	0

Multidrug Resistance

Table 38a. Resistance Patterns among *Salmonella* Newport Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	77	99	121	124	241	223	191	207	217	221	253	236
	Chicken Breasts					0	0	0	0	0	0	0	1
	Ground Turkey					3	2	2	3	0	0	3	3
	Ground Beef					3	1	2	0	0	0	3	2
	Pork Chops					2	1	0	0	0	0	0	0
	Chickens	1	7	5	8	6	7	0	6	0	3	1	0
	Turkeys	1	4	6	16	10	19	7	5	4	15	8	3
	Cattle	8	54	109	87	113	75	44	27	30	30	31	17
	Swine	1	5	2	7	0	3	0	1	1	1	2	0
Resistance Pattern	Isolate Source												
1. No Resistance Detected	Humans	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	89.1% 197	85.0% 215	89.8% 212
	Chicken Breasts												100.0% 1
	Ground Turkey					66.7% 2	50.0% 1	100.0% 2	100.0% 3			0.0% 0	66.7% 2
	Ground Beef					33.3% 1	0.0% 0	0.0% 0				33.3% 1	100.0% 2
	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	0.0% 0
	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	29.4% 5
	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	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	10.9% 24	13.8% 35	7.6% 18
	Chicken Breasts												0.0% 0
	Ground Turkey					33.3% 1	0.0% 0	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	0.0% 0
	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	33.3% 1
	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	70.6% 12
	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	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	9.5% 21	13.8% 35	6.8% 16
	Chicken Breasts												0.0% 0
	Ground Turkey					33.3% 1	0.0% 0	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	0.0% 0
	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	33.3% 1
	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	70.6% 12
	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	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	8.6% 19	13.0% 33	6.4% 15
	Chicken Breasts												0.0% 0
	Ground Turkey					33.3% 1	0.0% 0	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	0.0% 0
	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	33.3% 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	58.8% 10
	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, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	77	99	121	124	241	223	191	207	217	221	253	236
	Chicken Breasts					0	0	0	0	0	0	0	1
	Ground Turkey					3	2	2	3	0	0	3	3
	Ground Beef					3	1	2	0	0	0	3	2
	Pork Chops					2	1	0	0	0	0	0	0
	Chickens	1	7	5	8	6	7	0	6	0	3	1	0
	Turkeys	1	4	6	16	10	19	7	5	4	15	8	3
	Cattle	8	54	109	87	113	75	44	27	30	30	31	17
	Swine	1	5	2	7	0	3	0	1	1	1	2	0
	Resistance Pattern	Isolate Source											
5. At Least ACSSuT¹ Resistant	Humans	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	8.6% 19	11.9% 30	6.4% 15
	Chicken Breasts												0.0% 0
	Ground Turkey					33.3% 1	0.0% 0	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	0.0% 0
	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	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	47.1% 8
	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	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													0.0% 0
Ground Turkey						33.3% 1	0.0% 0	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	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	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	0.0% 0
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 ACSSuTAuCx³ Resistant		Humans	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	8.1% 18	11.9% 30
	Chicken Breasts												0.0% 0
	Ground Turkey					33.3% 1	0.0% 0	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	0.0% 0
	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	5.2% 1	14.3% 1	0.0% 0	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% 52	72.7% 32	81.5% 22	63.3% 19	70.0% 21	64.5% 20	47.1% 8
	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 Ceftriaxone and Nalidixic Acid Resistant	Humans	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													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						
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	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	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 ACSSuTAuCx = ACSSuT, amoxicillin-clavulanic acid, and ceftriaxone

H. Antimicrobial Susceptibility among *Salmonella* serotype Heidelberg

Table 39a. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	101	88	79	102	105	96	92	125	102	98	75	86	
	Chicken Breasts					11	16	31	22	30	14	30	45	
	Ground Turkey					21	32	37	53	35	41	56	10	
	Ground Beef					0	0	0	0	0	0	1	0	
	Pork Chops					3	0	3	0	4	0	0	1	
	Chickens	143	297	259	329	403	226	167	283	164	142	94	74	
	Turkeys	39	139	125	142	60	57	46	25	43	23	8	3	
	Cattle	11	28	6	10	8	9	1	6	4	0	3	0	
	Swine	37	33	22	16	11	11	4	8	13	2	1	4	
	Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source											
Aminoglycosides														
Aminoglycosides	Amikacin (MIC ≥ 64)	Humans	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Chicken Breasts	0	0	0	0	0	0	0	0	0	0	0	0
		Ground Turkey					0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Ground Beef											0.0%	
		Pork Chops					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
		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
	Gentamicin (MIC ≥ 16)	Humans	16.8%	14.8%	8.9%	7.8%	3.8%	5.2%	4.3%	6.4%	4.9%	16.3%	14.7%	2.3%
		Chicken Breasts	17	13	7	8	4	5	4	8	5	16	11	2
		Ground Turkey					45.5%	18.8%	9.7%	13.6%	20.0%	7.1%	30.0%	2.2%
		Ground Beef					5	3	3	3	6	1	9	1
		Pork Chops					28.6%	12.5%	35.1%	37.7%	31.4%	24.4%	57.1%	70.0%
		Chickens					6	4	13	20	11	10	32	7
		Turkeys											100.0%	
		Cattle											1	
		Swine					100.0%		0.0%		75.0%			0.0%
	Kanamycin (MIC ≥ 64)	Humans	12.9%	9.1%	15.2%	19.6%	10.5%	8.3%	8.7%	12.8%	8.8%	11.2%	26.7%	20.9%
		Chicken Breasts	13	8	12	20	11	8	8	16	9	11	20	18
		Ground Turkey					36.4%	0.0%	0.0%	0.0%	0.0%	7.1%	13.3%	15.6%
		Ground Beef					4	0	0	0	0	1	4	7
		Pork Chops					42.9%	34.4%	27.0%	30.2%	34.3%	56.1%	53.6%	20.0%
		Chickens					9	11	10	16	12	23	30	2
		Turkeys											100.0%	
		Cattle					0.0%							100.0%
		Swine					0							0
	Streptomycin (MIC ≥ 64)	Humans	30.7%	23.9%	22.8%	25.5%	17.1%	12.5%	15.2%	13.6%	11.8%	12.2%	30.7%	23.3%
		Chicken Breasts	31	21	18	26	18	12	14	17	12	12	23	20
		Ground Turkey					63.6%	12.5%	22.6%	18.2%	23.3%	21.4%	40.0%	13.3%
		Ground Beef					7	2	7	4	7	3	12	6
		Pork Chops					61.9%	37.5%	43.2%	47.2%	45.7%	39.0%	71.4%	60.0%
		Chickens					13	12	16	25	16	16	40	6
		Turkeys											100.0%	
		Cattle					100.0%		33.3%		0.0%			100.0%
		Swine					3		1		0			1
Aminoglycosides	Humans	32.9%	23.9%	36.7%	20.4%	18.6%	17.7%	18.0%	15.5%	10.4%	13.4%	16.0%	27.0%	
	Chicken Breasts	47	71	95	67	75	40	30	44	17	19	15	20	
	Ground Turkey					40.1%	35.0%	28.1%	44.0%	34.9%	26.1%	37.5%	66.7%	
	Ground Beef					12	21	16	11	15	6	3	2	
	Pork Chops					72.7%	57.1%	16.7%	20.0%	37.5%	55.6%	100.0%		
	Chickens					8	16	1	3	0			33.3%	
	Turkeys					81.1%	63.6%	86.4%	75.0%	45.5%	100.0%	75.0%	87.5%	
	Cattle					30	21	19	12	5	11	3	7	
	Swine													

Table 39b. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	101	88	79	102	105	96	92	125	102	98	75	86	
	Chicken Breasts					11	16	31	22	30	14	30	45	
	Ground Turkey					21	32	37	53	35	41	56	10	
	Ground Beef					0	0	0	0	0	0	1	0	
	Pork Chops					3	0	3	0	4	0	0	1	
	Chickens	143	297	259	329	403	226	167	283	164	142	94	74	
	Turkeys	39	139	125	142	60	57	46	25	43	23	8	3	
	Cattle	11	28	6	10	8	9	1	6	4	0	3	0	
	Swine	37	33	22	16	11	11	4	8	13	2	1	4	
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	1.1% 1	3.8% 3	2.9% 3	9.5% 10	5.2% 5	9.8% 9	8.8% 11	9.8% 10	7.1% 7	8.0% 6	20.9% 18
		Chicken Breasts					0.0% 0	6.3% 1	9.7% 3	13.6% 3	10.0% 3	21.4% 3	16.7% 5	31.1% 14
		Ground Turkey					19.0% 4	9.4% 3	5.4% 2	9.4% 5	17.1% 6	9.8% 4	7.1% 4	10.0% 1
		Ground Beef											0.0% 0	
		Pork Chops					0.0% 0		0.0% 0		0.0% 0			100.0% 1
		Chickens	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	17.6% 13
		Turkeys	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	33.3% 1
		Cattle	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	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	0.0% 0
Cephems	Cefoxitin (MIC ≥ 32 µg/ml)	Humans			2.5% 2	2.9% 3	8.6% 9	5.2% 5	7.6% 7	8.8% 11	8.8% 9	7.1% 7	8.0% 6	19.8% 17
		Chicken Breasts					0.0% 0	6.3% 1	9.7% 3	9.1% 2	10.0% 3	21.4% 3	16.7% 5	31.1% 14
		Ground Turkey					19.0% 4	0.0% 0	5.4% 2	9.4% 5	17.1% 6	9.8% 4	3.6% 2	10.0% 1
		Ground Beef											0.0% 0	
		Pork Chops					0.0% 0		0.0% 0		0.0% 0			100.0% 1
		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	17.6% 13
		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	33.3% 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	0.0% 0
	Ceftiofur (MIC ≥ 8 µg/ml)	Humans	0.0% 0	0.0% 0	3.8% 3	2.9% 3	7.6% 8	5.2% 5	8.7% 8	8.8% 11	9.8% 10	7.1% 7	8.0% 6	20.9% 18
		Chicken Breasts					0.0% 0	6.3% 1	9.7% 3	9.1% 2	10.0% 3	21.4% 3	16.7% 5	31.1% 14
		Ground Turkey					19.0% 4	0.0% 0	5.4% 2	9.4% 5	17.1% 6	9.8% 4	3.6% 2	10.0% 1
		Ground Beef											0.0% 0	
		Pork Chops					0.0% 0		0.0% 0		0.0% 0			100.0% 1
		Chickens	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	17.6% 13
		Turkeys	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	33.3% 1
		Cattle	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	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	0.0% 0
	Ceftriaxone (MIC ≥ 4 µg/ml)	Humans	0.0% 0	0.0% 0	3.8% 3	2.9% 3	7.6% 8	5.2% 5	8.7% 8	8.8% 11	9.8% 10	7.1% 7	8.0% 6	20.9% 18
		Chicken Breasts					0.0% 0	6.3% 1	9.7% 3	9.1% 2	10.0% 3	21.4% 3	16.7% 5	31.1% 14
		Ground Turkey					19.1% 4	0.0% 0	5.4% 2	9.4% 5	17.1% 6	9.8% 4	3.6% 2	10.0% 1
		Ground Beef											0.0% 0	
		Pork Chops					0.0% 0		0.0% 0		0.0% 0			100.0% 1
		Chickens	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	17.6% 13
		Turkeys	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	33.3% 1
		Cattle	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	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	0.0% 0

Table 39c. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		
Number of Isolates Tested	Humans	101	88	79	102	105	96	92	125	102	98	75	86		
	Chicken Breasts					11	16	31	22	30	14	30	45		
	Ground Turkey					21	32	37	53	35	41	56	10		
	Ground Beef					0	0	0	0	0	0	1	0		
	Pork Chops					3	0	3	0	4	0	0	1		
	Chickens	143	297	259	329	403	226	167	283	164	142	94	74		
	Turkeys	39	139	125	142	60	57	46	25	43	23	8	3		
	Cattle	11	28	6	10	8	9	1	6	4	0	3	0		
	Swine	37	33	22	16	11	11	4	8	13	2	1	4		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source													
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole ¹ (MIC ≥ 512 µg/ml)	Humans	21.8% 22	18.2% 16	11.4% 9	8.8% 9	6.7% 7	7.3% 7	7.6% 7	8.0% 10	4.9% 5	18.4% 18	12.0% 9	7.0% 6	
		Chicken Breasts					45.5% 5	12.5% 2	12.9% 4	13.6% 3	26.7% 8	7.1% 1	30.0% 9	2.2% 1	
		Ground Turkey					33.3% 7	15.6% 5	37.8% 14	35.8% 19	37.1% 13	26.8% 11	28.6% 16	50.0% 5	
		Ground Beef											100.0% 1		
		Pork Chops					100.0% 3		0.0% 0		100.0% 4			100.0% 1	
		Chickens	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	21.6% 16	
		Turkeys	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	0.0% 0	
		Cattle	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	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	0.0% 0	
	Trimethoprim- Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans	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	3.5% 3	
		Chicken Breasts					0.0% 0	0.0% 0	0.0% 0	0.0% 0	6.7% 2	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		100.0% 4			100.0% 1	
		Chickens	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	0.0% 0	
		Turkeys	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	0.0% 0	
		Cattle	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	9.1% 1	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	16.8% 17	6.8% 6	10.1% 8	9.8% 10	12.4% 13	10.4% 10	25.0% 23	20.0% 25	18.6% 19	18.4% 18	28.0% 21	27.9% 24
			Chicken Breasts					18.2% 2	18.8% 3	25.8% 8	27.3% 6	16.7% 5	21.4% 3	23.3% 7	31.1% 14
Ground Turkey							19.0% 4	9.4% 3	13.5% 5	18.9% 10	31.4% 11	53.7% 22	83.9% 47	80.0% 8	
Ground Beef													0.0% 0		
Pork Chops							0.0% 0		0.0% 0		0.0% 0			100.0% 1	
Chickens			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	20.3% 15	
Turkeys			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	66.7% 2	
Cattle			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			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	0.0% 0	
Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	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	4.7% 4	
		Chicken Breasts					0.0% 0	0.0% 0	3.2% 1	0.0% 0	0.0% 0	7.1% 1	3.3% 1	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			0.0% 0	
		Chickens	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	5.4% 4	
		Turkeys	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	0.0% 0	
		Cattle	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	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	0.0% 0	

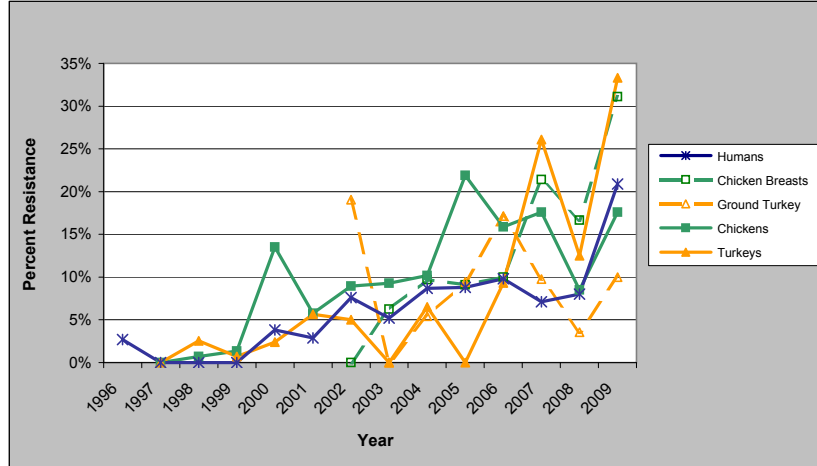
¹ Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

Table 39d. Antimicrobial Resistance among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	101	88	79	102	105	96	92	125	102	98	75	86	
	Chicken Breasts					11	16	31	22	30	14	30	45	
	Ground Turkey					21	32	37	53	35	41	56	10	
	Ground Beef					0	0	0	0	0	0	1	0	
	Pork Chops					3	0	3	0	4	0	0	1	
	Chickens	143	297	259	329	403	226	167	283	164	142	94	74	
	Turkeys	39	139	125	142	60	57	46	25	43	23	8	3	
	Cattle	11	28	6	10	8	9	1	6	4	0	3	0	
	Swine	37	33	22	16	11	11	4	8	13	2	1	4	
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	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			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	
		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	1.0% 1	1.1% 1	1.3% 1	0.0% 0	0.0% 0	1.0% 1	0.0% 0	0.8% 1	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	3.3% 1	0.0% 0	0.0% 0	0.0% 0
		Ground Turkey					4.8% 1	0.0% 0	0.0% 0	1.9% 1	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			0.0% 0
		Chickens	0.0% 0	0.3% 1	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	0.0% 0
		Turkeys	0.0% 0	0.7% 1	0.8% 1	0.0% 0	1.7% 1	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	
		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	19.8% 20	18.2% 16	21.5% 17	24.5% 25	19.0% 20	16.7% 16	19.6% 18	18.4% 23	13.7% 14	22.4% 22	36.0% 27	27.9% 24
		Chicken Breasts					45.5% 5	0.0% 0	6.5% 2	4.5% 1	3.3% 1	7.1% 1	26.7% 8	15.6% 7
		Ground Turkey					57.1% 12	43.8% 14	70.3% 26	56.6% 30	68.6% 24	70.7% 29	80.4% 45	60.0% 6
		Ground Beef											100.0% 1	
		Pork Chops					66.7% 2		100.0% 3		0.0% 0			100.0% 1
		Chickens	7.7% 11	7.7% 23	20.1% 52	14.9% 49	11.7% 47	16.4% 37	15.0% 25	14.5% 41	12.2% 20	12.7% 18	13.8% 13	14.9% 11
		Turkeys	23.1% 9	38.1% 53	64.0% 80	54.2% 77	70.0% 42	84.2% 48	73.9% 34	64.0% 16	62.8% 27	65.2% 15	87.5% 7	66.7% 2
		Cattle	63.6% 7	60.7% 17	33.3% 2	40.0% 4	62.5% 5	55.6% 5	100.0% 1	66.7% 4	0.0% 0		33.3% 1	
		Swine	73.0% 27	72.7% 24	81.8% 18	93.8% 15	72.7% 8	100.0% 11	75.0% 3	87.5% 7	92.3% 12	100.0% 2	100.0% 1	100.0% 4

Ceftriaxone Resistance

Figure 15. Percent of *Salmonella* Heidelberg Isolates from Humans, Retail Poultry, and Poultry Resistant to Ceftriaxone, by Year, 1996-2009¹



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 39 contains resistance data for *Salmonella* Heidelberg isolates from each source, by year

Table 40. Number of *Salmonella* Heidelberg Isolates Tested from Humans, Food Animals, and Retail Meats, by Year, 1996-2009

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	74	75	101	88	79	102	105	96	92	125	102	98	75	86
Chicken Breasts							11	16	31	22	30	14	30	45
Ground Turkey							21	32	37	53	35	41	56	10
Ground Beef							0	0	0	0	0	0	1	0
Pork Chops							3	0	3	0	4	0	0	1
Chickens		51	143	297	259	329	403	226	167	283	164	142	94	74
Turkeys		14	39	139	125	142	60	57	46	25	43	23	8	3
Cattle		1	11	28	6	10	8	9	1	6	4	0	3	0
Swine		7	37	33	22	16	11	11	4	8	13	2	1	4

Multidrug Resistance

Table 41a. Resistance Patterns among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	101	88	79	102	105	96	92	125	102	98	75	86
	Chicken Breasts					11	16	31	22	30	14	30	45
	Ground Turkey					21	32	37	53	35	41	56	10
	Ground Beef					0	0	0	0	0	0	1	0
	Pork Chops					3	0	3	0	4	0	0	1
	Chickens	143	297	259	329	403	226	167	283	164	142	94	74
	Turkeys	39	139	125	142	60	57	46	25	43	23	8	3
	Cattle	11	28	6	10	8	9	1	6	4	0	3	0
	Swine	37	33	22	16	11	11	4	8	13	2	1	4
Resistance Pattern	Isolate Source												
1. No Resistance Detected	Humans	56.4% 57	68.2% 60	63.3% 50	64.7% 66	67.6% 71	68.8% 66	56.5% 52	62.4% 78	67.6% 69	58.2% 57	57.3% 43	60.5% 52
	Chicken Breasts					27.3% 3	62.5% 10	58.1% 18	54.5% 12	50.0% 15	50.0% 7	50.0% 15	62.2% 28
	Ground Turkey					33.3% 7	50.0% 16	16.2% 6	20.8% 11	8.6% 3	9.8% 4	1.8% 1	10.0% 1
	Ground Beef											0.0% 0	
	Pork Chops					0.0% 0		0.0% 0		0.0% 0			0.0% 0
	Chickens	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	55.4% 41
	Turkeys	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	33.3% 1
	Cattle	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	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	0.0% 0
2. Resistant to ≥ 3 Antimicrobial Classes	Humans	13.9% 14	10.2% 9	7.6% 6	7.8% 8	12.4% 13	10.4% 10	13.0% 12	15.2% 19	12.7% 13	17.3% 17	28.0% 21	25.6% 22
	Chicken Breasts					45.5% 5	6.3% 1	12.9% 4	13.6% 3	13.3% 4	28.6% 4	36.7% 11	33.3% 15
	Ground Turkey					28.6% 6	12.5% 4	27.0% 10	34.0% 18	40.0% 14	53.7% 22	83.9% 47	70.0% 7
	Ground Beef											100.0% 1	
	Pork Chops					66.7% 2		0.0% 0		0.0% 0			100.0% 1
	Chickens	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	24.3% 18
	Turkeys	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	66.7% 2
	Cattle	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	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	0.0% 0
3. Resistant to ≥ 4 Antimicrobial Classes	Humans	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	17.4% 15
	Chicken Breasts					9.1% 1	0.0% 0	6.5% 2	0.0% 0	0.0% 0	0.0% 0	13.3% 4	8.9% 4
	Ground Turkey					19.1% 4	9.4% 3	10.8% 4	7.6% 4	17.1% 6	14.6% 6	19.6% 11	30.0% 3
	Ground Beef											0.0% 0	
	Pork Chops					0.0% 0		0.0% 0		0.0% 0			100.0% 1
	Chickens	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	9.5% 7
	Turkeys	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	33.3% 1
	Cattle	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	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	0.0% 0
4. Resistant to ≥ 5 Antimicrobial Classes	Humans	0.0% 0	0.0% 0	2.5% 2	1.0% 1	1.9% 2	0.0% 0	3.3% 3	1.6% 2	2.0% 2	4.1% 4	6.7% 5	15.1% 13
	Chicken Breasts					0.0% 0	0.0% 0	3.2% 1	0.0% 0	0.0% 0	0.0% 0	6.7% 2	8.9% 4
	Ground Turkey					19.1% 4	9.4% 3	5.4% 2	0.0% 0	8.6% 3	2.4% 1	1.8% 1	10.0% 1
	Ground Beef											0.0% 0	
	Pork Chops					0.0% 0		0.0% 0		0.0% 0			100.0% 1
	Chickens	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	8.1% 6
	Turkeys	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	33.3% 1
	Cattle	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	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	0.0% 0

Table 41b. Resistance Patterns among *Salmonella* Heidelberg Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	101	88	79	102	105	96	92	125	102	98	75	86
	Chicken Breasts					11	16	31	22	30	14	30	45
	Ground Turkey					21	32	37	53	35	41	56	10
	Ground Beef					0	0	0	0	0	0	1	0
	Pork Chops					3	0	3	0	4	0	0	1
	Chickens	143	297	259	329	403	226	167	283	164	142	94	74
	Turkeys	39	139	125	142	60	57	46	25	43	23	8	3
	Cattle	11	28	6	10	8	9	1	6	4	0	3	0
Swine	37	33	22	16	11	11	4	8	13	2	1	4	
Resistance Pattern	Isolate Source												
5. At Least ACSSuT¹ Resistant	Humans	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	3.5% 3
	Chicken Breasts					0.0% 0	0.0% 0	3.2% 1	0.0% 0	0.0% 0	0.0% 0	3.3% 1	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	0.0% 0
	Ground Beef											0.0% 0	
	Pork Chops					0.0% 0		0.0% 0		0.0% 0			0.0% 0
	Chickens	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	4.1% 3
	Turkeys	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	0.0% 0
	Cattle	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	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	0.0% 0
6. At Least ACT/S² Resistant	Humans	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	3.5% 3
	Chicken Breasts					0.0% 0	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	0.0% 0
	Ground Beef											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	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Turkeys	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	0.0% 0
	Cattle	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	9.1% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
7. At Least ACSSuTAuCx³ Resistant	Humans	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	1.2% 1
	Chicken Breasts					0.0% 0	0.0% 0	3.2% 1	0.0% 0	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	0.0% 0
	Ground Beef											0.0% 0	
	Pork Chops					0.0% 0		0.0% 0		0.0% 0			0.0% 0
	Chickens	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	4.1% 3
	Turkeys	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	0.0% 0
	Cattle	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	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
8. At Least Ceftriaxone 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	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	0.0% 0
	Ground Beef											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	1.0% 4	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	
	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 ACSSuTAuCx = ACSSuT, amoxicillin-clavulanic acid, and ceftriaxone

I. Antimicrobial Susceptibility among *Salmonella* serotype 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, 1998-2009

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		
Number of Isolates Tested														
Humans	0	8	13	14	35	37	36	33	105	73	83	72		
Chicken Breasts					5	2	4	9	9	2	4	8		
Ground Turkey					2	0	0	0	2	0	0	0		
Ground Beef					0	0	0	0	0	2	0	0		
Pork Chops					0	0	0	0	0	0	0	0		
Chickens	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29	21		
Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0	0		
Cattle	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1	1		
Swine	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	1	1		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Aminoglycosides	Amikacin (MIC ≥ 64 µg/ml)	Humans		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	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	0.0% 0	
		Gentamicin (MIC ≥ 16 µg/ml)	Humans		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	12.5% 1	
	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	4.8% 1	
	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	0.0% 0	
	Swine								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
	Kanamycin (MIC ≥ 64 µg/ml)	Humans		0.0% 0	0.0% 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	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	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	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	
	Swine								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
	Streptomycin (MIC ≥ 64 µg/ml)	Humans		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	12.5% 9
	Chicken Breasts					0.0% 0	0.0% 0	0.0% 0	11.1% 1	22.2% 2	0.0% 0	0.0% 0	12.5% 1	
	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	9.5% 2	
	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	0.0% 0	
	Swine								100.0% 1	0.0% 0	0.0% 0	100.0% 1	0.0% 0	

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* 14,[5],12:i:- Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	0	8	13	14	35	37	36	33	105	73	83	72
	Chicken Breasts					5	2	4	9	9	2	4	8
	Ground Turkey					2	0	0	0	2	0	0	0
	Ground Beef					0	0	0	0	0	2	0	0
	Pork Chops					0	0	0	0	0	0	0	0
	Chickens	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29	21
	Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0	0
	Cattle	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1	1
	Swine	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	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	2.9% 1	5.4% 2	2.8% 1	3.0% 1	3.8% 4	1.4% 1	3.6% 3	4.2% 3
		Chicken Breasts				0.0% 0	0.0% 0	0.0% 0	0.0% 0	11.1% 1	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	5.9% 6	16.5% 13	16.3% 8	3.4% 1	9.2% 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	0.0% 0
		Swine							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	2.9% 1	5.4% 2	2.8% 1	3.0% 1	3.8% 4	1.4% 1	3.6% 3	2.8% 2
		Chicken Breasts				0.0% 0	0.0% 0	0.0% 0	0.0% 0	11.1% 1	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	5.9% 6	16.5% 13	16.3% 8	3.4% 1	4.8% 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	0.0% 0
		Swine							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	7.1% 1	2.9% 1	5.4% 2	2.8% 1	3.0% 1	3.8% 4	2.7% 2	3.6% 3	2.8% 2
		Chicken Breasts				0.0% 0	0.0% 0	0.0% 0	0.0% 0	11.1% 1	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	5.9% 6	16.5% 13	16.3% 8	3.4% 1	9.5% 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	0.0% 0
		Swine							0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Ceftriaxone (MIC ≥ 4 µg/ml)	Humans	0.0% 0	0.0% 0	0.0% 0	2.9% 1	5.4% 2	2.8% 1	3.0% 1	3.8% 4	2.7% 2	3.6% 3	2.8% 2
		Chicken Breasts				0.0% 0	0.0% 0	0.0% 0	0.0% 0	11.1% 1	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	5.9% 6	16.5% 13	16.3% 8	3.4% 1	9.5% 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	0.0% 0
		Swine							0.0% 0	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

Table 42c. Antimicrobial Resistance among *Salmonella* I 4,[5],12:i:- Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	0	8	13	14	35	37	36	33	105	73	83	72	
	Chicken Breasts					5	2	4	9	9	2	4	8	
	Ground Turkey					2	0	0	0	2	0	0	0	
	Ground Beef					0	0	0	0	0	2	0	0	
	Pork Chops					0	0	0	0	0	0	0	0	
	Chickens	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29	21	
	Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0	0	
	Cattle	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1	1	
	Swine	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	1	1	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source												
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole ² (MIC ≥ 512 µg/ml)	Humans		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	13.9% 10
		Chicken Breasts					0.0% 0	0.0% 0	0.0% 0	11.1% 1	22.2% 2	50.0% 1	0.0% 0	25.0% 2
		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	9.5% 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	0.0% 0
		Swine								100.0% 1	50.0% 1	0.0% 0	100.0% 1	0.0% 0
	Trimethoprim- Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Humans		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	1.4% 1
		Chicken Breasts					0.0% 0	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	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
		Swine								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	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	11.1% 8
		Chicken Breasts					0.0% 0	0.0% 0	0.0% 0	0.0% 0	11.1% 1	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							6.8% 3	8.8% 9	17.7% 14	20.4% 10	6.9% 2	9.5% 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	0.0% 0
		Swine								100.0% 1	50.0% 1	0.0% 0	100.0% 1	0.0% 0
Phenicols	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans		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	8.3% 6
		Chicken Breasts					0.0% 0	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	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
		Swine								0.0% 0	50.0% 1	0.0% 0	100.0% 1	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 Sulfamethoxazole was tested from 1996-2003 and was replaced by sulfisoxazole in 2004

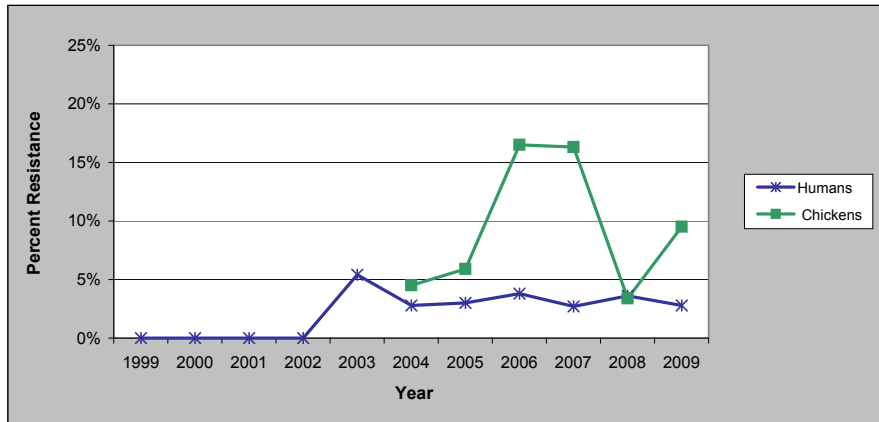
Table 42d. Antimicrobial Resistance among *Salmonella* I 4,[5],12:i:- Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	0	8	13	14	35	37	36	33	105	73	83	72	
	Chicken Breasts					5	2	4	9	9	2	4	8	
	Ground Turkey					2	0	0	0	2	0	0	0	
	Ground Beef					0	0	0	0	0	2	0	0	
	Pork Chops					0	0	0	0	0	0	0	0	
	Chickens	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29	21	
	Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0	0	
	Cattle	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1	1	
	Swine	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	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	
		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	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
		Swine								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Humans		0.0% 0	0.0% 0	0.0% 0	0.0% 0	2.7% 1	2.8% 1	0.0% 0	1.0% 1	1.4% 1	1.2% 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			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	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
		Swine								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Humans		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	16.7% 12
		Chicken Breasts					0.0% 0	0.0% 0	0.0% 0	11.1% 1	11.1% 1	0.0% 0	0.0% 0	25.0% 2
		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	9.5% 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	0.0% 0
		Swine								100.0% 1	50.0% 1	0.0% 0	100.0% 1	0.0% 0

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, 1999-2009¹



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, 1996-2009

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	3	3	0	8	13	14	35	37	36	33	105	73	83	72
Chicken Breasts							5	2	4	9	9	2	4	8
Ground Turkey							2	0	0	0	2	0	0	0
Ground Beef							0	0	0	0	0	2	0	0
Pork Chops							0	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	21
Turkeys		N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0	0
Cattle		N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1	1
Swine		N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	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, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	0	8	13	14	35	37	36	33	105	73	83	72
	Chicken Breasts					5	2	4	9	9	2	4	8
	Ground Turkey					2	0	0	0	2	0	0	0
	Ground Beef					0	0	0	0	0	2	0	0
	Pork Chops					0	0	0	0	0	0	0	0
	Chickens	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29	21
	Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0	0
	Cattle	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1	1
	Swine	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	1	1
Resistance Pattern	Isolate Source												
1. No Resistance Detected	Humans		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	76.4% 55
	Chicken Breasts					100.0% 5	100.0% 2	100.0% 4	88.9% 8	55.6% 5	50.0% 1	100.0% 4	75.0% 6
	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	76.2% 16
	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	100.0% 1
	Swine								0.0% 0	50.0% 1	100.0% 1	0.0% 0	100.0% 1
2. Resistant to ≥ 3 Antimicrobial Classes	Humans		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	12.5% 9
	Chicken Breasts					0.0% 0	0.0% 0	0.0% 0	11.1% 1	22.2% 2	0.0% 0	0.0% 0	12.5% 1
	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	9.5% 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	0.0% 0
	Swine								100.0% 1	50.0% 1	0.0% 0	100.0% 1	0.0% 0
3. Resistant to ≥ 4 Antimicrobial Classes	Humans		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	9.7% 7
	Chicken Breasts					0.0% 0	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	4.8% 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	0.0% 0
	Swine								100.0% 1	50.0% 1	0.0% 0	100.0% 1	0.0% 0
4. Resistant to ≥ 5 Antimicrobial Classes	Humans		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	6.9% 5
	Chicken Breasts					0.0% 0	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	4.8% 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	0.0% 0
	Swine								0.0% 0	0.0% 0	0.0% 0	100.0% 1	0.0% 0

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* 14,[5],12:i:- Isolates from Humans, Retail Meats, and Food Animals, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	0	8	13	14	35	37	36	33	105	73	83	72	
	Chicken Breasts					5	2	4	9	9	2	4	8	
	Ground Turkey					2	0	0	0	2	0	0	0	
	Ground Beef					0	0	0	0	0	2	0	0	
	Pork Chops					0	0	0	0	0	0	0	0	
	Chickens	N/A	N/A	N/A	N/A	N/A	N/A	N/A	44	102	79	49	29	21
	Turkeys	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	2	1	1	0	0
	Cattle	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	2	3	6	1	1
	Swine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1	2	1	1	1
Resistance Pattern	Isolate Source													
5. At Least ACSSuT² Resistant	Humans		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	6.9% 5	
	Chicken Breasts					0.0% 0	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	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	
	Swine								0.0% 0	0.0% 0	0.0% 0	100.0% 1	0.0% 0	
6. At Least ACT/S³ Resistant	Humans		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	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	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	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	
	Swine								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
7. At Least ACSSuTAuCx⁴ 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	2.4% 2	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	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	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	
	Swine								0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
8. At Least Ceftriaxone 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	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	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	
	Swine								0.0% 0	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 ACSSuTAuCx = ACSSuT, amoxicillin-clavulanic acid, and ceftriaxone

IV. *Campylobacter* Data

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

Table 45. Number of *Campylobacter jejuni* Isolates Tested, by Source and Year, 1998-2009¹

Source	Year												
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	209	297	293	306	365	329	303	320	791	709	992	1046	1355
Chicken Breasts						198	325	510	403	426	332	329	403
Ground Turkey						2	4	7	10	12	20	10	9
Chickens					64 ²	526	374	508	567	228	166	78	117

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 46. Number of *Campylobacter coli* Isolates Tested, by Source and Year, 1998-2009¹

Source	Year												
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	6	8	20	12	17	25	22	26	98	97	105	110	143
Chicken Breasts						90	142	196	151	145	143	181	179
Ground Turkey						2	1	5	9	10	14	19	15
Chickens					52 ²	288	247	186	380	123	76	28	81

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 47. Number and Percent of Retail Meat Samples Culture Positive for *Campylobacter*, 2009¹

	Chicken Breasts	Ground Turkey
Number of Meat Samples Tested	1320	1320
Number Positive for <i>Campylobacter</i>	582	24
Percent Positive for <i>Campylobacter</i>	44.1%	1.8%

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

Figure 17. Percent of Retail Meat Samples Culture Positive for *Campylobacter*, 2009

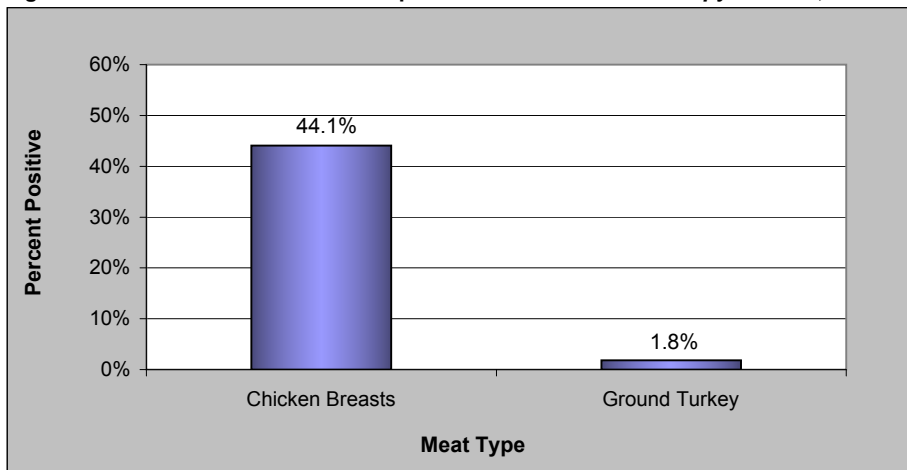
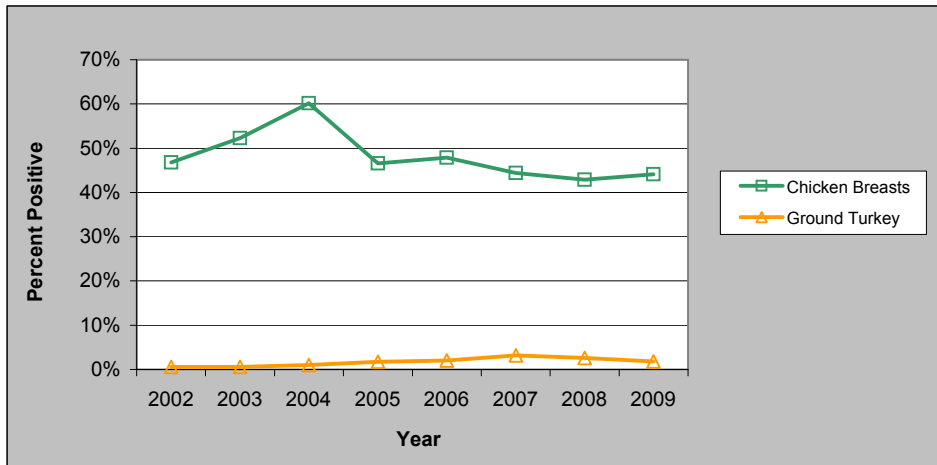


Figure 18. Percent of Retail Meat Samples Culture Positive for *Campylobacter*, 2002-2009



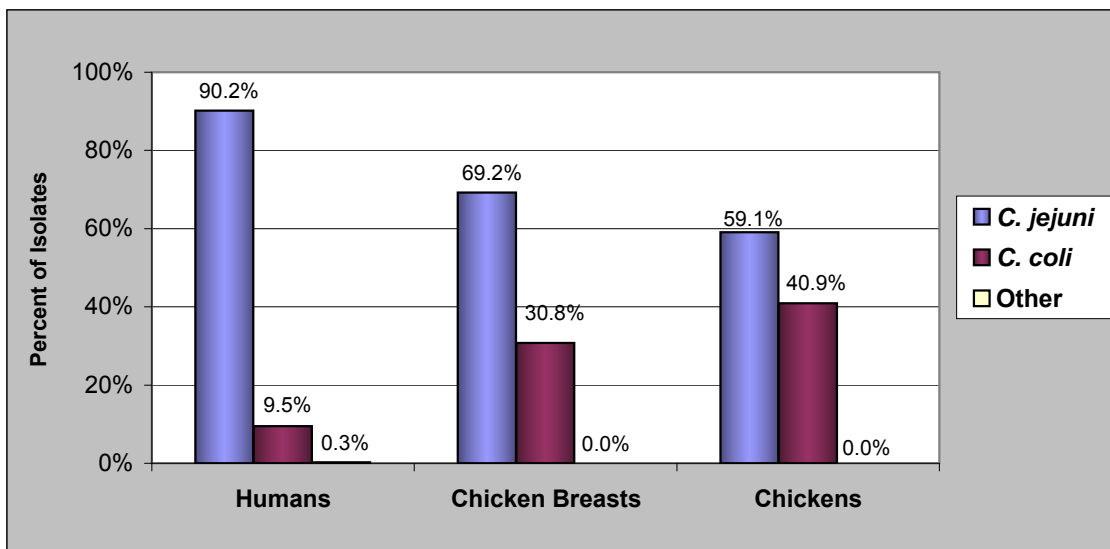
C. Campylobacter Species

Table 48. *Campylobacter* Species Isolated from Humans, Retail Meats, and Chickens, 2009

	Humans	Retail Meats ¹		Food Animals
<i>Campylobacter</i> Species	Humans (N=1502)	Chicken Breasts (N=582)	Ground Turkey (N=24)	Chickens (N=198)
<i>C. jejuni</i>	90.2% 1355	69.2% 403	37.5% 9	59.1% 117
<i>C. coli</i>	9.5% 143	30.8% 179	62.5% 15	40.9% 81
Other	0.3% 4	0.0% 0	0.0% 0	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 19. *Campylobacter* Species Isolated from Humans, Chicken Breasts, and Chickens, 2009



D. Antimicrobial Susceptibility among *Campylobacter jejuni*

MIC Distributions

Table 49a. Distribution of MICs and Occurrence of Resistance among *Campylobacter jejuni* Isolates from Humans, Retail Meats, and Chickens, 2009

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 (1355)	0.0	0.7	[0.3 - 1.3]				1.1	23.0	63.2	11.7	0.3						0.7
	Chicken Breasts (403)	0.0	0.0	[0.0 - 0.9]					1.0	49.4	49.6							
	Ground Turkey (9)	0.0	0.0	[0.0 - 33.6]						33.3	66.7							
	Chickens (117)	0.0	0.9	[0.0 - 4.7]				17.9	50.4	30.8								0.9
Ketolides																		
Telithromycin	Humans (1355)	0.5	1.4	[0.8 - 2.2]			<0.1	0.1	8.0	33.6	38.4	16.2	1.8	0.5		1.4		
	Chicken Breasts (403)	0.5	0.2	[0.0 - 1.4]				0.2	7.7	36.2	41.7	12.4	1.0	0.5		0.2		
	Ground Turkey (9)	0.0	0.0	[0.0 - 33.6]						22.2	55.6	22.2						
	Chickens (117)	0.0	0.0	[0.0 - 3.1]				1.7	20.5	51.3	22.2	4.3						
Lincosamides																		
Clindamycin	Humans (1355)	0.2	1.3	[0.8 - 2.1]		1.5	17.3	45.4	27.8	5.0	1.3	0.1	0.2		0.3	0.4		0.7
	Chicken Breasts (403)	0.2	0.5	[0.1 - 1.8]			3.7	42.4	46.2	6.2	0.5	0.2	0.2		0.5			
	Ground Turkey (9)	11.1	0.0	[0.0 - 33.6]				22.2	66.7				11.1					
	Chickens (117)	0.0	0.0	[0.0 - 3.1]		2.6	42.7	41.0	12.0	1.7								
Macrolides																		
Azithromycin	Humans (1355)	0.0	1.5	[1.0 - 2.4]	0.7	16.8	48.0	26.7	5.8	0.4	<0.1							1.5
	Chicken Breasts (403)	0.0	1.0	[0.3 - 2.5]	1.2	22.3	64.5	9.9	1.0									1.0
	Ground Turkey (9)	0.0	0.0	[0.0 - 33.6]		11.1	44.4	44.4										
	Chickens (117)	0.0	0.0	[0.0 - 3.1]	3.4	57.3	36.8	2.6										
Erythromycin	Humans (1355)	0.0	1.5	[1.0 - 2.4]				1.7	25.2	48.7	18.7	3.6	0.4					1.5
	Chicken Breasts (403)	0.0	1.0	[0.3 - 2.5]				1.7	34.5	45.2	17.6						0.2	0.7
	Ground Turkey (9)	0.0	0.0	[0.0 - 33.6]					33.3	44.4		22.2						
	Chickens (117)	0.0	0.0	[0.0 - 3.1]				8.5	41.0	41.9	6.8	1.7						

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. Discrepancies between %R and sums of distribution %'s, to the right of the double vertical bars, are due to rounding

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 49b. Distribution of MICs and Occurrence of Resistance among *Campylobacter jejuni* Isolates from Humans, Retail Meats, and Chickens, 2009

Antimicrobial	Isolate Source				Distribution (%) of MICs ($\mu\text{g/ml}$) 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 (1355)	N/A	0.6	[0.3 - 1.2]																		
	Chicken Breasts (403)	N/A	0.0	[0.0 - 0.9]																		
	Ground Turkey (9)	N/A	0.0	[0.0 - 33.6]																		
	Chickens (117)	N/A	0.0	[0.0 - 3.1]																		
Quinolones Ciprofloxacin	Humans (1355)	<0.1	23.0	[20.8 - 25.4]	1.1	27.8	40.3	5.9	1.7	0.2	<0.1	1.5	9.1	7.4	3.1	1.4						
	Chicken Breasts (403)	0.0	21.1	[17.2 - 25.4]	0.5	8.4	58.3	11.7				5.0	7.9	8.2								
	Ground Turkey (9)	0.0	44.4	[13.7 - 78.8]				22.2				11.1	11.1									
	Chickens (117)	0.0	19.7	[12.9 - 28.0]				4.3	47.9	26.5	1.7	1.7	12.0	5.1	0.9							
Nalidixic acid	Humans (1355)	0.0	23.2	[21.0 - 25.5]								64.1	11.1	1.6			2.6	20.6				
	Chicken Breasts (403)	0.0	21.1	[17.2 - 25.4]								59.6	19.4				0.5	20.6				
	Ground Turkey (9)	0.0	44.4	[13.7 - 78.8]								55.6					33.3	11.1				
	Chickens (117)	0.0	19.7	[12.9 - 28.0]								76.9					3.4	8.5	11.1			
Tetracyclines Tetracycline	Humans (1355)	0.1	43.4	[40.7 - 46.1]					4.3	26.3	16.5	6.0	2.7	0.5	<0.1	0.1	0.4	2.5	9.9	30.6		
	Chicken Breasts (403)	0.0	46.2	[41.2 - 51.2]								16.4	23.8	10.7	2.2	0.7			1.0	5.5	13.6	26.1
	Ground Turkey (9)	0.0	100.0	[66.4 - 100.0]										22.2	77.8							
	Chickens (117)	0.9	49.6	[40.2 - 59.0]					3.4	23.1	13.7			6.0	2.6	0.9	0.9	1.7	8.5	22.2	17.1	

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. Discrepancies between %R and sums of distribution %'s, to the right of the double vertical bars, are due to rounding

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 ($\leq 4 \mu\text{g/ml}$) has been established. In this report, isolates with an MIC $\geq 8 \mu\text{g/ml}$ are categorized as resistant

Resistance by Year

Table 50a. Antimicrobial Resistance among *Campylobacter jejuni* Isolates from Humans, Retail Meats, and Chickens, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	297	293	306	365	329	303	320	791	709	992	1046	1355	
	Chicken Breasts					198	325	510	403	426	332	329	403	
	Ground Turkey					2	4	7	10	12	20	10	9	
	Chickens				64 ¹	526	374	508	567	228	166	78	117	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)²	Isolate Source³												
Aminoglycosides	Gentamicin (MIC ≥ 8 µg/ml)	Humans	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.5%	0.0%	0.7%	1.1%	0.7%
		Chicken Breasts	1	0	0	0	0	0	1	4	0	7	12	9
		Ground Turkey					0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Chickens				0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	1.3%	0.9%
Ketolides	Telithromycin (MIC ≥ 16 µg/ml)	Humans							0.6%	0.8%	1.0%	2.2%	1.4%	
		Chicken Breasts						0.4%	0.5%	0.7%	0.6%	0.3%	0.2%	
		Ground Turkey						0.0%	0.0%	0.0%	5.0%	10.0%	0.0%	
		Chickens							0.4%	0.0%	0.0%	0.0%	0.0%	
Lincosamides	Clindamycin (MIC ≥ 8 µg/ml)	Humans	1.0%	0.7%	0.7%	1.9%	1.8%	0.0%	2.2%	1.1%	1.0%	1.3%	2.1%	1.3%
		Chicken Breasts	3	2	2	7	6	0	7	9	7	13	22	18
		Ground Turkey							0.0%	0.0%	0.0%	5.0%	10.0%	0.0%
		Chickens				0.0%	0.4%	0.8%	0.2%	0.4%	0.0%	0.0%	0.0%	0.0%
Macrolides	Azithromycin (MIC ≥ 8 µg/ml)	Humans	0.3%	1.4%	1.6%	1.9%	1.8%	0.3%	0.6%	1.8%	0.8%	1.6%	2.3%	1.5%
		Chicken Breasts	1	4	5	7	6	1	2	14	6	16	24	21
		Ground Turkey							0.0%	0.0%	0.0%	5.0%	10.0%	0.0%
		Chickens				3.1%	0.6%	1.3%	1.6%	1.4%	0.4%	0.0%	1.3%	0.0%
	Erythromycin (MIC ≥ 32 µg/ml)	Humans	0.7%	1.4%	1.0%	1.9%	1.2%	0.3%	0.3%	1.6%	0.8%	1.6%	2.3%	1.5%
		Chicken Breasts	2	4	3	7	4	1	1	13	6	16	24	21
		Ground Turkey					0.0%	0.0%	0.0%	0.0%	0.0%	5.0%	10.0%	0.0%
		Chickens				3.1%	0.6%	1.6%	1.2%	1.1%	0.4%	0.0%	1.3%	0.0%
Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	0.7%	0.3%	0.0%	0.3%	0.3%	0.0%	1.6%					
		Chickens	2	1	0	1	1	0	5					
	Florfenicol (MIC ≥ 8) ⁴	Humans								0.5%	0.0%	0.0%	0.6%	0.6%
		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%	
	Chickens								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 50b. Antimicrobial Resistance among *Campylobacter jejuni* Isolates from Humans, Retail Meats, and Chickens, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	297	293	306	365	329	303	320	791	709	992	1046	1355	
	Chicken Breasts					198	325	510	403	426	332	329	403	
	Ground Turkey					2	4	7	10	12	20	10	9	
	Chickens				64 ¹	526	374	508	567	228	166	78	117	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)²	Isolate Source³												
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	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% 234	23.0% 312
		Chicken Breasts					15.2% 30	14.5% 47	15.1% 77	15.1% 61	16.7% 71	17.2% 57	14.6% 48	21.1% 85
		Ground Turkey					50.0% 1	0.0% 0	28.6% 2	10.0% 1	50.0% 6	30.0% 6	60.0% 6	44.4% 4
		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	19.7% 23
	Nalidixic acid (MIC ≥ 64 µg/ml)	Humans	15.5% 46	19.5% 57	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% 239	23.2% 314
		Chicken Breasts							15.1% 77	14.9% 60	16.7% 71	17.2% 57	14.6% 48	21.1% 85
		Ground Turkey							28.6% 2	10.0% 1	50.0% 6	30.0% 6	60.0% 6	44.4% 4
		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	19.7% 23
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	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% 463	43.4% 588
		Chicken Breasts							50.2% 256	46.4% 187	47.2% 201	48.5% 161	49.8% 164	46.2% 186
		Ground Turkey							42.9% 3	70.0% 7	75.0% 9	90.0% 18	100.0% 10	100.0% 9
		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	49.6% 58

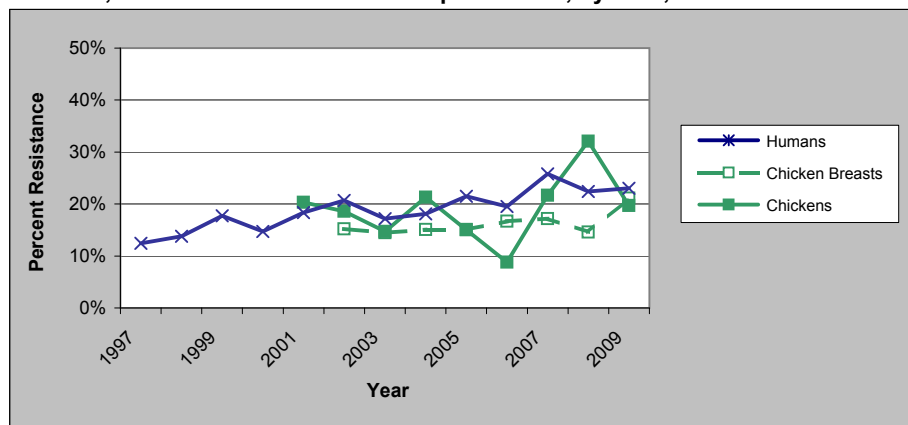
¹ These isolates were recovered from July through December, 2001, when the new ARS isolation method was used

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

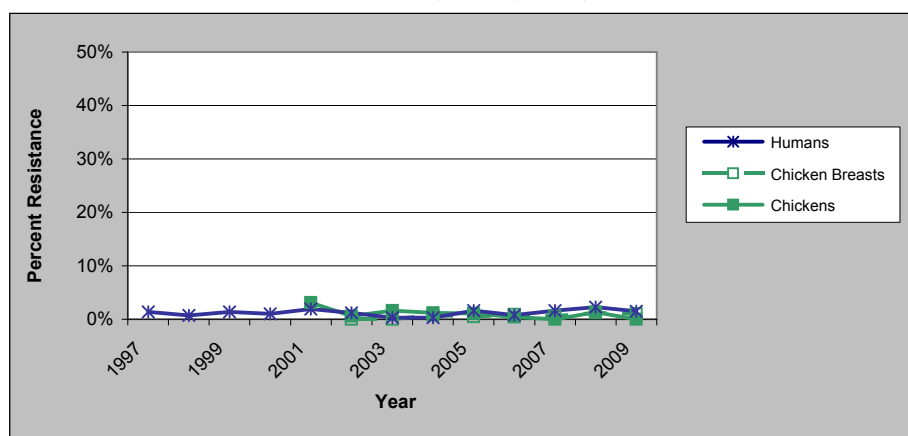
Figure 20. Percent of *Campylobacter jejuni* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Ciprofloxacin, by Year, 1997-2009¹



¹Data for ground turkey, ground beef, and pork chops are not included due to the small number of *C. jejuni* isolates from these sources. Table 50 contains resistance data for *C. jejuni* isolates from each source, by year

Erythromycin Resistance

Figure 21. Percent of *Campylobacter jejuni* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Erythromycin by Year, 1997-2009¹



¹Data for ground turkey, ground beef, and pork chops are not included due to the small number of *C. jejuni* isolates from these sources. Table 50 contains resistance data for *C. jejuni* isolates from each source, by year

Table 51. Number of *Campylobacter jejuni* Isolates Tested from Humans, Retail Meats², and Chickens by Year, 1997-2009

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	209	297	293	306	365	329	303	320	791	709	992	1046	1355
Chicken Breasts						198	325	510	403	426	332	329	403
Ground Turkey						2	4	7	10	12	20	10	9
Chickens					64 ¹	526	374	508	567	228	166	78	117

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 52. Resistance Patterns among *Campylobacter jejuni* Isolates from Humans, Retail Meats and Food Animals, by Year, 2004-2009¹

Year		2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	N/A ¹	791	709	992	1046	1355
	Chicken Breasts	510	403	426	332	329	403
	Ground Turkey	7	10	12	20	10	9
	Chickens	N/A ¹	567	228	166	78	117
Resistance Patterns	Isolate Source²						
1. No Resistance Detected	Humans		48.0% 380	43.7% 310	45.5% 451	46.1% 482	46.6% 632
	Chicken Breasts	41.0% 209	43.4% 175	43.9% 187	40.4% 134	40.4% 133	41.9% 169
	Ground Turkey	42.9% 3	30.0% 3	16.7% 2	10.0% 2	0.0% 0	0.0% 0
	Chickens		46.9% 266	39.9% 91	34.3% 57	33.3% 26	41.9% 49
2. Resistance to ≥ 2 Antimicrobial Classes	Humans		13.8% 109	11.4% 81	17.4% 173	14.7% 154	13.9% 189
	Chicken Breasts	7.1% 36	6.0% 24	8.7% 37	7.2% 24	7.0% 23	10.7% 43
	Ground Turkey	14.3% 1	10.0% 1	41.7% 5	30.0% 6	70.0% 7	44.4% 4
	Chickens		8.3% 47	5.3% 12	12.7% 21	23.1% 18	12.0% 14
3. Resistance to ≥ 3 Antimicrobial Classes	Humans		1.3% 10	0.7% 5	1.3% 13	2.2% 23	1.5% 21
	Chicken Breasts	0.4% 2	0.5% 2	0.7% 3	0.6% 2	0.3% 1	0.2% 1
	Ground Turkey	0.0% 0	0.0% 0	0.0% 0	5.0% 1	10.0% 1	0.0% 0
	Chickens		0.5% 3	0.0% 0	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	1.1% 11	0.9% 12
	Chicken Breasts	0.4% 2	0.3% 1	0.7% 3	0.0% 0	0.0% 0	0.0% 0
	Ground Turkey	0.0% 0	0.0% 0	0.0% 0	5.0% 1	10.0% 1	0.0% 0
	Chickens		0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
5. At Least Quinolone and Macrolide Resistant	Humans		1.0% 8	0.6% 4	1.3% 13	1.5% 16	1.1% 15
	Chicken Breasts	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	5.0% 1	0.0% 0	0.0% 0
	Chickens		0.2% 1	0.4% 1	0.0% 0	1.3% 1	0.0% 0
6. At Least Quinolone and Tetracycline Resistant	Humans		12.4% 98	10.7% 76	17.0% 169	13.7% 143	13.3% 180
	Chicken Breasts	6.3% 32	5.5% 22	8.0% 34	6.6% 22	6.1% 20	10.2% 41
	Ground Turkey	14.3% 1	10.0% 1	41.7% 5	30.0% 6	60.0% 6	44.4% 4
	Chickens		7.2% 41	4.8% 11	12.7% 21	20.5% 16	11.1% 13

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 53a. Distribution of MICs and Occurrence of Resistance among *Campylobacter coli* Isolates from Humans, Retail Meats, and Chickens, 2009

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	
Aminoglycosides																				
Gentamicin	Humans (143)	0.0	2.8	[0.8 - 7.0]						0.7	5.6	48.3	39.9	2.8					2.8	
	Chicken Breasts (179)	0.0	5.6	[2.7 - 10.0]								56.4	38.0					5.6		
	Ground Turkey (15)	0.0	0.0	[0.0 - 21.8]								53.3	46.7							
	Chickens (81)	0.0	2.5	[0.3 - 8.6]								32.1	65.4					2.5		
Ketolides																				
Telithromycin	Humans (143)	4.9	2.1	[0.4 - 6.0]				0.7	0.7	11.2	18.9	21.0	21.0	19.6	4.9			2.1		
	Chicken Breasts (179)	0.6	4.5	[1.9 - 8.6]						0.6	17.3	8.9	15.6	39.1	13.4	0.6			4.5	
	Ground Turkey (15)	0.0	0.0	[0.0 - 21.8]								13.3	6.7	33.3	40.0	6.7				
	Chickens (81)	0.0	6.2	[2.0 - 13.8]						4.9	12.3	8.6	40.7	25.9	1.2			6.2		
Lincosamides																				
Clindamycin	Humans (143)	1.4	2.1	[0.4 - 6.0]			0.7	5.6	16.8	28.7	29.4	11.9	3.5	1.4			1.4	0.7		
	Chicken Breasts (179)	1.7	3.4	[1.2 - 7.2]					0.6	7.8	61.5	19.0	3.4	2.8	1.7	0.6	1.7	1.1		
	Ground Turkey (15)	0.0	0.0	[0.0 - 21.8]							6.7	53.3	33.3	6.7						
	Chickens (81)	6.2	0.0	[0.0 - 4.5]					1.2	48.1	37.0	3.7	2.5	1.2	6.2					
Macrolides																				
Azithromycin	Humans (143)	0.0	2.8	[0.8 - 7.0]	0.7	2.1	18.2	47.6	25.2	3.5									2.8	
	Chicken Breasts (179)	0.0	4.5	[1.9 - 8.6]			3.4	46.9	40.8	4.5									4.5	
	Ground Turkey (15)	0.0	0.0	[0.0 - 21.8]			6.7	46.7	33.3	13.3										
	Chickens (81)	0.0	6.2	[2.0 - 13.8]			9.9	65.4	18.5									6.2		
Erythromycin	Humans (143)	0.0	2.8	[0.8 - 7.0]				0.7	0.7	5.6	34.3	29.4	16.8	9.1	0.7			0.7	2.1	
	Chicken Breasts (179)	0.0	4.5	[1.9 - 8.6]						0.6	17.3	25.7	40.2	10.6	1.1				4.5	
	Ground Turkey (15)	0.0	0.0	[0.0 - 21.8]								13.3	33.3	46.7	6.7					
	Chickens (81)	0.0	6.2	[2.0 - 13.8]						1.2	16.0	37.0	33.3	6.2					6.2	

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. Discrepancies between %R and sums of distribution %'s, to the right of the double vertical bars, are due to rounding

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 53b. Distribution of MICs and Occurrence of Resistance among *Campylobacter coli* Isolates from Humans, Retail Meats, and Chickens, 2009

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
Phenicol																		
Florfenicol ⁶	Humans (143)	N/A	0.0	[0.0 - 2.5]														
	Chicken Breasts (179)	N/A	0.0	[0.0 - 2.0]														
	Ground Turkey (15)	N/A	0.0	[0.0 - 21.8]														
	Chickens (81)	N/A	0.0	[0.0 - 4.5]														
Quinolones																		
Ciprofloxacin	Humans (143)	0.7	21.7	[15.2 - 29.3]														
	Chicken Breasts (179)	0.0	18.4	[13.0 - 24.9]														
	Ground Turkey (15)	0.0	46.7	[21.3 - 73.4]														
	Chickens (81)	0.0	22.2	[13.7 - 32.8]														
Nalidixic acid	Humans (143)	0.7	23.1	[16.4 - 30.9]														
	Chicken Breasts (179)	0.0	18.4	[13.0 - 24.9]														
	Ground Turkey (15)	0.0	46.7	[21.3 - 73.4]														
	Chickens (81)	0.0	22.2	[13.7 - 32.8]														
Tetracyclines																		
Tetracycline	Humans (143)	0.0	44.8	[36.4 - 53.3]														
	Chicken Breasts (179)	0.6	38.0	[30.9 - 45.5]														
	Ground Turkey (15)	0.0	73.3	[44.9 - 92.2]														
	Chickens (81)	0.0	44.4	[33.4 - 55.9]														

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. Discrepancies between %R and sums of distribution %'s, to the right of the double vertical bars, are due to rounding

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 54a. Antimicrobial Resistance among *Campylobacter coli* Isolates from Humans, Retail Meats, and Chickens, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		
Number of Isolates Tested	Humans	8	20	12	17	25	22	26	98	97	105	110	143		
	Chicken Breasts					90	142	196	151	145	143	181	179		
	Ground Turkey					2	1	5	9	10	14	19	15		
	Chickens				52 ¹	288	247	186	380	123	76	28	81		
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)²	Isolate Source³													
Aminoglycosides	Gentamicin (MIC ≥ 8 µg/ml)	Humans	0.0% 0	0.0% 0	8.3% 1	0.0% 0	0.0% 0	4.5% 1	0.0% 0	2.0% 2	1.0% 1	0.0% 0	0.9% 1	2.8% 4	
		Chicken Breasts					0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.7% 1	1.7% 3	5.6% 10	
		Ground Turkey					0.0% 0	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	0.3% 1	0.0% 0	1.3% 1	3.6% 1	2.5% 2	
Ketolides	Telithromycin (MIC ≥ 16 µg/ml)	Humans							4.1% 4	7.2% 7	5.7% 6	5.5% 6	2.1% 3		
		Chicken Breasts						8.2% 16	7.9% 12	4.8% 7	7.0% 10	7.7% 14	4.5% 8		
		Ground Turkey						0.0% 0	22.2% 2	0.0% 0	0.0% 0	5.3% 1	0.0% 0		
		Chickens							5.5% 21	6.5% 8	13.2% 10	3.6% 1	6.2% 5		
Lincosamides	Clindamycin (MIC ≥ 8 µg/ml)	Humans	12.5% 1	10.0% 2	8.3% 1	5.9% 1	4.0% 1	9.1% 2	0.0% 0	4.1% 4	9.3% 9	5.7% 6	9.1% 10	2.1% 3	
		Chicken Breasts							7.1% 14	8.6% 13	4.8% 7	4.9% 7	5.0% 9	3.4% 6	
		Ground Turkey							0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	
		Chickens				1.9% 1	4.9% 14	4.5% 11	1.1% 2	2.4% 9	1.6% 2	9.2% 7	3.6% 1	0.0% 0	
Macrolides	Azithromycin (MIC ≥ 8 µg/ml)	Humans	12.5% 1	10.0% 2	8.3% 1	5.9% 1	4.0% 1	9.1% 2	0.0% 0	3.1% 3	8.2% 8	5.7% 6	10.0% 11	2.8% 4	
		Chicken Breasts							9.2% 18	9.9% 15	5.5% 8	6.3% 9	9.9% 18	4.5% 8	
		Ground Turkey							0.0% 0	22.2% 2	0.0% 0	0.0% 0	5.3% 1	0.0% 0	
		Chickens				11.5% 6	19.4% 56	20.2% 50	9.1% 17	8.4% 32	8.9% 11	14.5% 11	10.7% 3	6.2% 5	
	Erythromycin (MIC ≥ 32 µg/ml)	Humans	12.5% 1	10.0% 2	8.3% 1	5.9% 1	4.0% 1	9.1% 2	0.0% 0	3.1% 3	8.2% 8	5.7% 6	10.0% 11	2.8% 4	
		Chicken Breasts							7.8% 7	7.0% 10	9.2% 18	5.5% 8	6.3% 9	9.9% 18	4.5% 8
		Ground Turkey							0.0% 0	0.0% 0	22.2% 2	0.0% 0	0.0% 0	5.3% 1	0.0% 0
		Chickens				9.6% 5	18.8% 54	20.2% 50	9.1% 17	8.4% 32	8.9% 11	14.5% 11	10.7% 3	6.2% 5	
Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)	Humans	25.0% 2	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						
	Florfenicol (MIC > 4) ⁴	Humans								1.0% 1	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	
	Ground Turkey							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		

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 54b. Antimicrobial Resistance among *Campylobacter coli* Isolates from Humans, Retail Meats, and Chickens, by Year, 1998-2009

Year		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
Number of Isolates Tested	Humans	8	20	12	17	25	22	26	98	97	105	110	143	
	Chicken Breasts					90	142	196	151	145	143	181	179	
	Ground Turkey					2	1	5	9	10	14	19	15	
	Chickens				52 ¹	288	247	186	380	123	76	28	81	
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)²	Isolate Source³												
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Humans	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	30.0% 33	21.7% 31
		Chicken Breasts					10.0% 9	13.4% 19	16.3% 32	29.1% 44	22.1% 32	25.9% 37	20.4% 37	18.4% 33
		Ground Turkey					50.0% 1	100.0% 1	0.0% 0	55.6% 5	30.0% 3	50.0% 7	47.4% 9	46.7% 7
		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	22.2% 18
	Nalidixic acid (MIC ≥ 64 µg/ml)	Humans	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	30.0% 33	23.1% 33
		Chicken Breasts							16.3% 32	29.1% 44	20.7% 30	25.9% 37	20.4% 37	18.4% 33
		Ground Turkey							0.0% 0	55.6% 5	30.0% 3	50.0% 7	47.4% 9	46.7% 7
		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	22.2% 18
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	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	40.0% 44	44.8% 64
		Chicken Breasts							46.4% 91	42.4% 64	46.9% 68	39.9% 57	46.4% 84	38.0% 68
		Ground Turkey							0.0% 0	88.9% 8	80.0% 8	64.3% 9	94.7% 18	73.3% 11
		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	44.4% 36

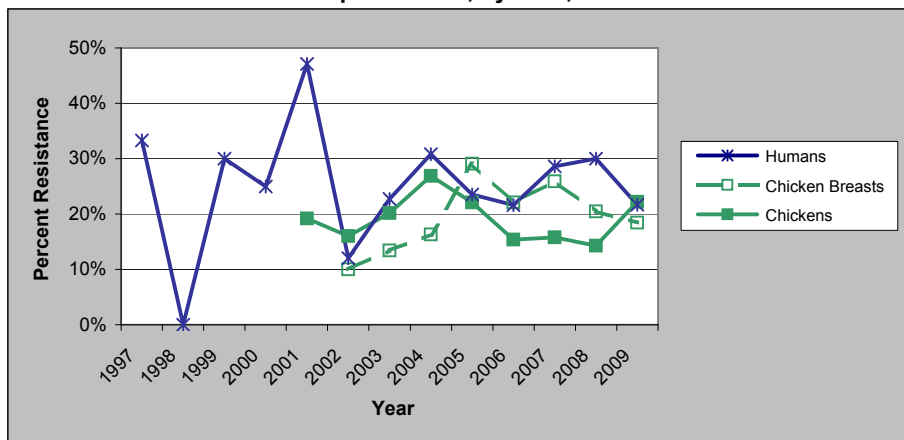
¹ These isolates were recovered from July through December, 2001, when the new ARS isolation method was used

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

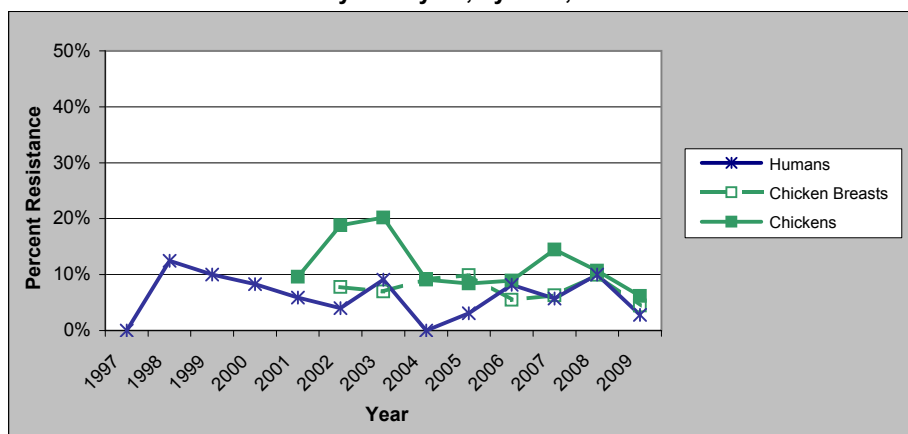
Figure 22. Percent of *Campylobacter coli* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Ciprofloxacin, by Year, 1997-2009¹



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 54 contains resistance data for *C. coli* isolates from each source, by year

Erythromycin Resistance

Figure 23. Percent of *Campylobacter coli* Isolates from Humans, Chicken Breasts, and Chickens Resistant to Erythromycin, by Year, 1997-2009¹



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 54 contains resistance data for *C. coli* isolates from each source, by year

Table 55. Number of *Campylobacter coli* Isolates Tested from Humans, Retail Meats¹, and Chickens, by Year, 1997-2009

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Humans	6	8	20	12	17	25	22	26	98	97	105	110	143
Chicken Breasts						90	142	196	151	145	143	181	179
Ground Turkey						2	1	5	9	10	14	19	15
Chickens					52 ²	288	247	186	380	123	76	28	81

¹ Beginning in 2008, ground beef and pork chops were no longer tested for *Campylobacter* due to low isolation in previous years. Data for 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 56. Resistance Patterns among *Campylobacter coli* Isolates from Humans, Retail Meats and Food Animals, by Year, 2004-2009¹

Year		2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Humans	N/A ¹	98	97	105	110	143
	Chicken Breasts	196	151	145	143	181	179
	Ground Turkey	5	9	10	14	19	15
	Chickens	N/A ¹	380	123	76	28	81
Resistance Patterns	Isolate Source²						
1. No Resistance Detected	Humans		51.0% 50	45.4% 44	40.0% 42	42.7% 47	44.1% 63
	Chicken Breasts	38.3% 75	36.4% 55	38.6% 56	45.5% 65	41.4% 75	48.6% 87
	Ground Turkey	100.0% 5	11.1% 1	20.0% 2	28.6% 4	5.3% 1	20.0% 3
	Chickens		47.6% 181	39.0% 48	43.4% 33	28.6% 8	49.4% 40
2. Resistance to ≥ 2 Antimicrobial Classes	Humans		12.2% 12	16.5% 16	18.1% 19	24.5% 27	12.6% 18
	Chicken Breasts	15.3% 30	19.9% 30	15.2% 22	19.6% 28	24.3% 44	15.6% 28
	Ground Turkey	0.0% 0	55.6% 5	30.0% 3	42.9% 6	52.6% 10	40.0% 6
	Chickens		21.6% 82	17.9% 22	21.1% 16	17.9% 5	19.8% 16
3. Resistance to ≥ 3 Antimicrobial Classes	Humans		3.1% 3	7.2% 7	5.7% 6	5.5% 6	2.1% 3
	Chicken Breasts	8.2% 16	9.3% 14	5.5% 8	7.0% 10	6.1% 11	4.5% 8
	Ground Turkey	0.0% 0	22.2% 2	0.0% 0	0.0% 0	5.3% 1	0.0% 0
	Chickens		5.8% 22	6.5% 8	13.2% 10	7.1% 2	6.2% 5
4. Resistance to ≥ 4 Antimicrobial Classes	Humans		1.0% 1	2.1% 2	1.0% 1	1.8% 2	2.1% 3
	Chicken Breasts	1.5% 3	4.6% 7	2.1% 3	2.8% 4	2.2% 4	1.7% 3
	Ground Turkey	0.0% 0	22.2% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Chickens		1.3% 5	0.8% 1	3.9% 3	0.0% 0	4.9% 4
5. At Least Quinolone and Macrolide Resistant	Humans		1.0% 1	3.1% 3	1.9% 2	3.6% 4	2.1% 3
	Chicken Breasts	0.5% 1	1.3% 2	0.0% 0	1.4% 2	1.1% 2	1.7% 3
	Ground Turkey	0.0% 0	22.2% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0
	Chickens		1.6% 6	1.6% 2	5.3% 4	0.0% 0	4.9% 4
6. At Least Quinolone and Tetracycline Resistant	Humans		9.2% 9	10.3% 10	13.3% 14	17.3% 19	12.6% 18
	Chicken Breasts	7.1% 14	11.3% 17	10.3% 15	14.7% 21	13.3% 24	7.3% 13
	Ground Turkey	0.0% 0	55.6% 5	30.0% 3	42.9% 6	47.4% 9	40.0% 6
	Chickens		13.9% 53	9.8% 12	10.5% 8	14.3% 4	16.0% 13

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

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 57. Number of *E. coli* Isolates Tested, by Source and Year, 2000-2009

Source	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Chicken Breasts			282	396	400	393	418	299	306	315
Ground Turkey			304	333	376	396	388	315	300	306
Ground Beef			295	311	338	316	295	256	250	247
Pork Chops			184	218	232	205	182	152	146	147
Chickens	285	1989	2100	1365	1697	2232	1357	1510	986	877

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

Table 58. Number and Percent of Retail Meat Samples Culture Positive for *E. coli*, 2009

	Chicken Breasts	Ground Turkey	Ground Beef	Pork Chops
Number of Meat Samples Tested	360	360	360	360
Number Positive for <i>E. coli</i>	315	306	247	147
Percent Positive for <i>E. coli</i>	87.5%	85.0%	68.6%	40.8%

Figure 24. Percent of Retail Meat Samples Culture Positive for *E. coli*, 2009

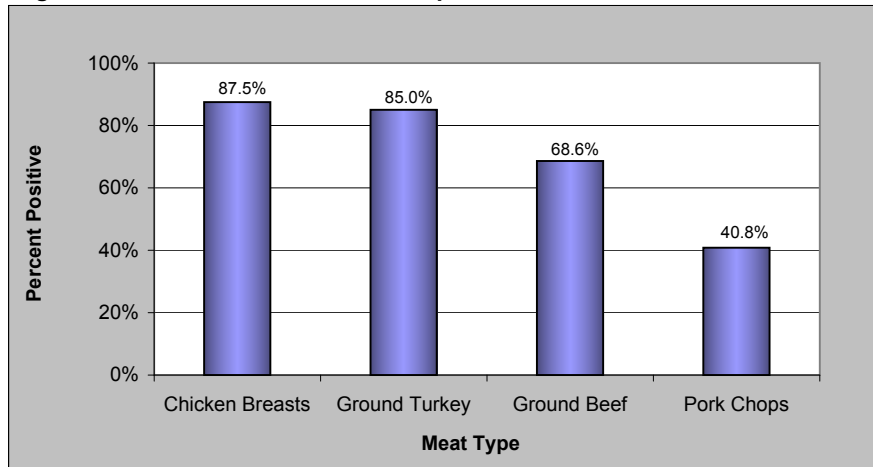
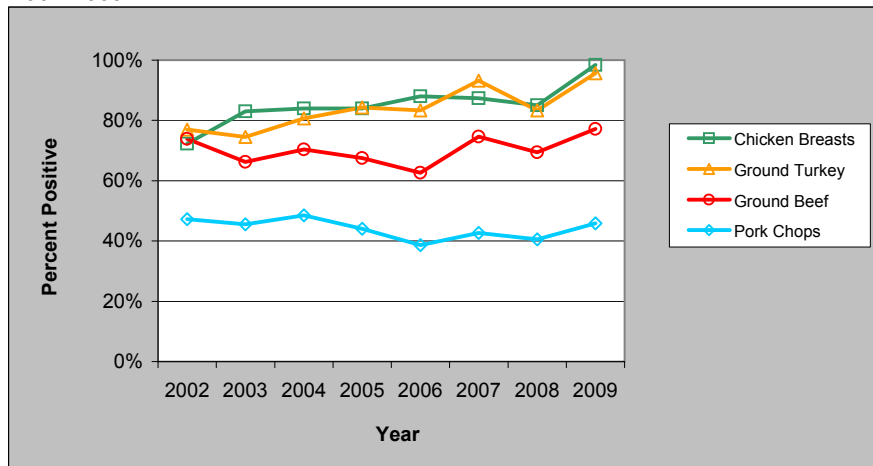


Figure 25. Percent of Retail Meat Samples Culture Positive for *E. coli*, 2002-2009



C. Antimicrobial Susceptibility among *E. coli*

MIC Distributions

Table 59a. Distribution of MICs and Occurrence of Resistance among *E. coli* Isolates from Retail Meats and Chickens, 2009

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
Aminoglycosides																				
Amikacin	Chicken Breasts (315)	0.0	0.0	[0.0 - 1.2]																
	Ground Turkey (306)	0.0	0.0	[0.0 - 1.2]																
	Ground Beef (247)	0.0	0.0	[0.0 - 1.5]																
	Pork Chops (147)	0.0	0.0	[0.0 - 2.5]																
	Chickens (877)	0.0	0.0	[0.0 - 0.4]																
Gentamicin	Chicken Breasts (315)	2.2	34.3	[29.1 - 39.8]																
	Ground Turkey (306)	2.0	37.9	[32.4 - 43.6]																
	Ground Beef (247)	0.4	0.8	[0.1 - 2.9]																
	Pork Chops (147)	0.0	4.1	[1.5 - 8.7]																
	Chickens (877)	3.6	43.3	[40.0 - 46.7]																
Kanamycin	Chicken Breasts (315)	0.3	5.4	[3.2 - 8.5]																
	Ground Turkey (306)	0.0	20.6	[16.2 - 25.6]																
	Ground Beef (247)	0.0	2.0	[0.7 - 4.7]																
	Pork Chops (147)	0.0	6.1	[2.8 - 11.3]																
	Chickens (877)	1.0	7.9	[6.2 - 9.9]																
Streptomycin	Chicken Breasts (315)	N/A	38.1	[32.7 - 43.7]																
	Ground Turkey (306)	N/A	57.5	[51.8 - 63.1]																
	Ground Beef (247)	N/A	8.1	[5.0 - 12.2]																
	Pork Chops (147)	N/A	19.7	[13.6 - 27.1]																
	Chickens (877)	N/A	49.8	[46.5 - 53.2]																
β-Lactam/β-Lactamase Inhibitor Combinations																				
Amoxicillin-Clavulanic Acid	Chicken Breasts (315)	1.0	13.3	[9.8 - 17.6]																
	Ground Turkey (306)	14.4	9.8	[6.7 - 13.7]																
	Ground Beef (247)	0.0	1.6	[0.4 - 4.1]																
	Pork Chops (147)	0.0	6.8	[3.3 - 12.2]																
	Chickens (877)	0.5	12.4	[10.3 - 14.8]																
Cephems																				
Cefoxitin	Chicken Breasts (315)	0.0	13.3	[9.8 - 17.6]																
	Ground Turkey (306)	1.6	7.8	[5.1 - 11.4]																
	Ground Beef (247)	0.0	1.6	[0.4 - 4.1]																
	Pork Chops (147)	0.7	6.8	[3.3 - 12.2]																
	Chickens (877)	1.1	11.4	[9.4 - 13.7]																

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates with resistance. Discrepancies between %R and sums of distribution %'s, to the right of the double vertical bars, are due to rounding

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 59b. Distribution of MICs and Occurrence of Resistance among *E. coli* Isolates from Retail Meats and Chickens, 2009

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
Cephems																					
Ceftiofur	Chicken Breasts (315)	0.6	11.7	[8.4 - 15.8]	2.5	28.3	54.6	1.3	1.0	0.6	6.4	5.4									
	Ground Turkey (306)	0.7	6.2	[3.8 - 9.5]	2.0	29.1	57.8	3.6	0.7	0.7	3.6	2.6									
	Ground Beef (247)	0.0	0.8	[0.1 - 2.9]	7.3	39.3	51.8	0.4	0.4			0.8									
	Pork Chops (147)	0.0	6.8	[3.3 - 12.2]	10.2	42.2	39.5	1.4				3.4	3.4								
	Chickens (877)	2.1	9.5	[7.6 - 11.6]	5.0	43.9	37.2	2.3	0.1	2.1	6.5	3.0									
Ceftriaxone	Chicken Breasts (315)	0.0	12.4	[9.0 - 16.5]	86.3	0.6	0.6				0.3	5.7	4.4	1.9							
	Ground Turkey (306)	0.0	6.9	[4.3 - 10.3]	91.2	0.7	1.3				3.6	2.9	0.3								
	Ground Beef (247)	0.0	0.8	[0.1 - 2.9]	98.4		0.8					0.4	0.4								
	Pork Chops (147)	0.0	6.8	[3.3 - 12.2]	93.2							3.4	2.7	0.7							
	Chickens (877)	0.1	11.5	[9.5 - 13.8]	87.6	0.7	0.1	0.1	1.4	6.4	3.5	0.2									
Folate Pathway Inhibitors																					
Sulfisoxazole	Chicken Breasts (315)	N/A	40.6	[35.2 - 46.3]								41.0	16.5	1.9					40.6		
	Ground Turkey (306)	N/A	53.9	[48.2 - 59.6]								29.4	15.0	1.6					53.9		
	Ground Beef (247)	N/A	7.7	[4.7 - 11.8]								70.4	19.0	2.8					7.7		
	Pork Chops (147)	N/A	14.3	[9.1 - 21.0]								53.7	27.2	4.8					14.3		
	Chickens (877)	N/A	52.6	[49.2 - 55.9]								43.8	3.1	0.2	0.1	0.2			52.6		
Trimethoprim-Sulfamethoxazole	Chicken Breasts (315)	N/A	2.2	[0.9 - 4.5]	78.1	13.0	4.1	1.6	1.0			2.2									
	Ground Turkey (306)	N/A	5.9	[3.5 - 9.1]	69.3	16.3	6.2	1.0	1.3			5.9									
	Ground Beef (247)	N/A	2.0	[0.7 - 4.7]	93.9	3.6	0.4				2.0										
	Pork Chops (147)	N/A	2.7	[0.7 - 6.8]	88.4	6.1	2.7				2.7										
	Chickens (877)	N/A	7.0	[5.4 - 8.8]	68.4	14.6	6.2	2.7	1.1	0.2	6.7										
Penicillins																					
Ampicillin	Chicken Breasts (315)	0.0	22.2	[17.8 - 27.2]					9.2	41.9	25.7	1.0			22.2						
	Ground Turkey (306)	0.3	56.2	[50.4 - 61.8]					2.6	26.8	13.4	0.7	0.3			56.2					
	Ground Beef (247)	0.0	4.9	[2.5 - 8.3]					15.8	51.4	27.9				4.9						
	Pork Chops (147)	0.0	11.6	[6.9 - 17.9]					12.9	52.4	21.8	1.4			11.6						
	Chickens (877)	0.0	19.8	[17.2 - 22.6]					15.1	46.9	17.8	0.5			0.2	19.6					
Phenicol																					
Chloramphenicol	Chicken Breasts (315)	1.0	0.6	[0.1 - 2.3]					7.3	57.5	33.7	1.0			0.6						
	Ground Turkey (306)	0.3	3.3	[1.6 - 5.9]					4.6	52.0	39.9	0.3	0.3	2.9							
	Ground Beef (247)	0.4	2.4	[0.9 - 5.2]					6.5	50.2	40.5	0.4			2.4						
	Pork Chops (147)	1.4	4.8	[1.9 - 9.6]					6.8	55.8	31.3	1.4	1.4	3.4							
	Chickens (877)	0.2	1.1	[0.5 - 2.1]					15.4	65.1	18.1	0.2	0.3	0.8							

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates with resistance. Discrepancies between %R and sums of distribution %s, to the right of the double vertical bars, are due to rounding

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 59c. Distribution of MICs and Occurrence of Resistance among *E. coli* Isolates from Retail Meats and Chickens, 2009

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
Quinolones																		
Ciprofloxacin	Chicken Breasts (315)	0.0	0.3	[0.0 - 1.8]														
	Ground Turkey (306)	0.0	0.7	[0.1 - 2.3]														
	Ground Beef (247)	0.0	0.0	[0.0 - 1.5]														
	Pork Chops (147)	0.0	0.0	[0.0 - 2.5]														
	Chickens (877)	0.0	0.5	[0.1 - 1.2]														
Nalidixic Acid	Chicken Breasts (315)	N/A	2.9	[1.3 - 5.4]														
	Ground Turkey (306)	N/A	2.6	[1.1 - 5.1]														
	Ground Beef (247)	N/A	0.4	[0.0 - 2.2]														
	Pork Chops (147)	N/A	0.0	[0.0 - 2.5]														
	Chickens (877)	N/A	3.2	[2.1 - 4.6]														
Tetracyclines																		
Tetracycline	Chicken Breasts (315)	1.3	41.6	[36.1 - 47.2]														
	Ground Turkey (306)	0.0	82.0	[77.3 - 86.2]														
	Ground Beef (247)	4.9	18.6	[14.0 - 24.0]														
	Pork Chops (147)	2.7	46.9	[38.7 - 55.3]														
	Chickens (877)	0.8	49.1	[45.8 - 52.5]														

¹ Percent of isolates with intermediate susceptibility

² Percent of isolates with resistance. Discrepancies between %R and sums of distribution %'s, to the right of the double vertical bars, are due to rounding

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 60a. Antimicrobial Resistance among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2009

Year			2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Chicken Breasts				282	396	400	393	418	299	306	315
	Ground Turkey				304	333	376	396	388	315	300	306
	Ground Beef				295	311	338	316	295	256	250	247
	Pork Chops				184	218	232	205	182	152	146	147
	Chickens		285	1989	2100	1365	1697	2232	1357	1510	986	877
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%
		Ground Turkey			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%
		Pork Chops			0	0	0	0	0	0	0	0
		Chickens	0.0%	0.0%	0	0	0	0	0	0	0	0
	Gentamicin (MIC ≥ 16 µg/ml)	Chicken Breasts			23.1%	29.3%	30.0%	37.7%	37.3%	34.4%	34.0%	34.3%
		Ground Turkey			65	116	120	148	156	103	104	108
		Ground Beef			27.0%	29.7%	29.3%	27.5%	29.6%	27.0%	37.0%	37.9%
		Pork Chops			82	99	110	109	115	85	111	116
		Chickens	40.0%	33.4%	38.0%	38.8%	39.1%	36.7%	33.1%	38.0%	44.5%	43.3%
	Kanamycin (MIC ≥ 64 µg/ml)	Chicken Breasts			6.0%	6.8%	6.8%	7.1%	11.5%	9.0%	6.9%	5.4%
		Ground Turkey			17	27	27	28	48	27	21	17
		Ground Beef			13.2%	16.8%	16.0%	11.4%	14.7%	15.6%	19.0%	20.6%
		Pork Chops			40	56	60	45	57	49	57	63
		Chickens	16.1%	14.5%	11.6%	10.3%	11.5%	10.3%	9.1%	7.7%	10.2%	7.9%
	Streptomycin (MIC ≥ 16 µg/ml)	Chicken Breasts			49.3%	56.1%	56.8%	50.6%	48.1%	46.8%	43.8%	38.1%
		Ground Turkey			139	222	227	199	201	140	134	120
		Ground Beef			57.6%	54.7%	49.2%	43.4%	43.8%	44.8%	57.3%	57.5%
		Pork Chops			175	182	185	172	170	141	172	176
		Chickens	77.5%	65.8%	65.1%	64.2%	64.1%	58.0%	49.5%	47.0%	54.6%	49.8%
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid (MIC ≥ 32 / 16 µg/ml)	Chicken Breasts			12.1%	13.6%	10.0%	12.2%	11.5%	7.4%	11.8%	13.3%
		Ground Turkey			34	54	40	48	48	22	36	42
		Ground Beef			5.6%	3.0%	5.3%	3.8%	6.7%	6.3%	8.3%	9.8%
		Pork Chops			17	10	20	15	26	20	25	30
		Chickens	8.1%	10.0%	10.9%	11.1%	8.8%	10.6%	16.0%	11.2%	13.7%	12.4%
Cephems	Cefoxitin (MIC ≥ 32 µg/ml)	Chicken Breasts			11.0%	9.3%	8.3%	11.2%	11.2%	7.4%	11.8%	13.3%
		Ground Turkey			31	37	33	44	47	22	36	42
		Ground Beef			3.3%	1.2%	4.5%	3.3%	6.2%	6.3%	6.3%	7.8%
		Pork Chops			10	4	17	13	24	20	19	24
		Chickens	7.4%	8.7%	8.5%	8.3%	8.2%	9.9%	15.0%	10.3%	13.8%	11.4%
	Ceftiofur (MIC ≥ 8 µg/ml)	Chicken Breasts			7.1%	7.6%	5.8%	8.7%	8.6%	6.0%	10.8%	11.8%
		Ground Turkey			20	30	23	34	36	18	33	37
		Ground Beef			1.0%	0.3%	1.1%	1.8%	3.1%	6.0%	3.7%	6.2%
		Pork Chops			3	1	4	7	12	19	11	19
		Chickens	6.3%	4.4%	0.0%	0.3%	0.9%	0.6%	1.0%	0.8%	1.6%	0.8%
	Ceftriaxone (MIC ≥ 4 µg/ml)	Chicken Breasts			0.5%	0.9%	0.4%	0.0%	0.0%	0.7%	3.4%	6.8%
		Ground Turkey			1	2	1	0	0	1	5	10
		Ground Beef			0.5%	0.9%	0.4%	0.5%	0.6%	0.7%	3.4%	6.8%
		Pork Chops			1	2	1	1	1	1	5	10
		Chickens	6.3%	7.6%	8.6%	9.4%	7.2%	9.0%	14.7%	10.3%	13.5%	11.5%

Table 60b. Antimicrobial Resistance among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2009

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		
Number of Isolates Tested	Chicken Breasts			282	396	400	393	418	299	306	315		
	Ground Turkey			304	333	376	396	388	315	300	306		
	Ground Beef			295	311	338	316	295	256	250	247		
	Pork Chops			184	218	232	205	182	152	146	147		
	Chickens	285	1989	2100	1365	1697	2232	1357	1510	986	877		
	Antimicrobial Class	Antimicrobial (Resistance Breakpoint)	Isolate Source										
Folate Pathway Inhibitors	Sulfamethoxazole/ Sulfisoxazole ¹ (MIC ≥ 512 µg/ml)	Chicken Breasts			32.3%	38.4%	41.3%	48.1%	46.9%	42.1%	39.2%	40.6%	
		Ground Turkey			91	152	165	189	196	126	120	128	
		Ground Beef			48.0%	51.7%	48.4%	48.0%	48.5%	48.9%	51.0%	53.9%	
		Pork Chops			146	172	182	190	188	154	153	165	
		Chickens	57.9%	58.2%	46.1%	43.9%	53.2%	51.9%	48.6%	53.2%	52.7%	52.6%	
	29	32	44	22	37	24	29	37	18	24	21		
	12.5%	15.1%	19.4%	14.1%	20.3%	11.8%	16.4%	14.3%	23	33	45	29	37
	57.9%	58.2%	46.1%	43.9%	53.2%	51.9%	48.6%	53.2%	52.7%	52.6%			
	165	1157	969	599	903	1159	660	804	520	461			
	Trimethoprim- Sulfamethoxazole (MIC ≥ 4 / 76 µg/ml)	Chicken Breasts			3.6%	7.1%	4.3%	7.4%	8.9%	5.0%	3.6%	2.2%	
Ground Turkey				10	28	17	29	37	15	11	7		
Ground Beef				4.0%	6.9%	3.7%	5.1%	8.0%	7.9%	5.3%	5.9%		
Pork Chops				12	23	14	20	31	25	16	18		
Chickens		17.2%	12.6%	10.4%	10.5%	10.7%	10.4%	8.4%	7.9%	9.1%	7.0%		
49	251	218	144	181	232	114	120	90	61				
Penicillins	Ampicillin (MIC ≥ 32 µg/ml)	Chicken Breasts			21.6%	25.3%	17.0%	24.7%	20.1%	18.1%	23.5%	22.2%	
		Ground Turkey			61	100	68	97	84	54	72	70	
		Ground Beef			31.3%	35.7%	33.2%	38.1%	42.0%	48.3%	58.0%	56.2%	
		Pork Chops			95	119	125	151	163	152	174	172	
		Chickens	20.0%	19.5%	19.0%	18.6%	17.6%	22.0%	25.6%	18.7%	23.5%	19.8%	
57	388	399	254	298	492	347	282	232	174				
Phenicol	Chloramphenicol (MIC ≥ 32 µg/ml)	Chicken Breasts			0.7%	0.0%	1.8%	0.5%	2.6%	2.0%	1.0%	0.6%	
		Ground Turkey			2	0	7	2	11	6	3	2	
		Ground Beef			0.3%	3.6%	0.8%	4.0%	2.3%	2.9%	3.7%	3.3%	
		Pork Chops			1	12	3	16	9	9	11	10	
		Chickens	4.6%	2.4%	1.8%	1.3%	1.0%	1.0%	1.9%	2.3%	1.0%	1.1%	
13	47	38	18	17	22	26	34	10	10				
Quinolones	Ciprofloxacin (MIC ≥ 4 µg/ml)	Chicken Breasts			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	
		Ground Turkey			0	0	0	0	0	0	0	1	
		Ground Beef			0.0%	0.3%	0.8%	0.0%	0.5%	0.3%	0.0%	0.7%	
		Pork Chops			0	1	3	0	2	1	0	2	
		Chickens	0.0%	0.2%	0.0%	0.1%	0.2%	0.4%	0.0%	0.1%	0.6%	0.5%	
	0	3	0	1	3	8	0	1	6	4			
	Nalidixic Acid (MIC ≥ 32 µg/ml)	Chicken Breasts			2.8%	4.0%	7.0%	6.6%	5.0%	3.0%	2.9%	2.9%	
		Ground Turkey			8	16	28	26	21	9	9	9	
		Ground Beef			4.3%	11.7%	10.6%	10.4%	5.2%	2.2%	3.7%	2.6%	
		Pork Chops			13	39	40	41	20	7	11	8	
Chickens		10.2%	8.4%	6.8%	6.2%	6.8%	7.5%	5.4%	4.2%	6.0%	3.2%		
29	168	142	84	115	168	73	64	59	28				
Tetracyclines	Tetracycline (MIC ≥ 16 µg/ml)	Chicken Breasts			46.1%	42.9%	48.0%	46.6%	50.5%	40.5%	43.8%	41.6%	
		Ground Turkey			130	170	192	183	211	121	134	131	
		Ground Beef			77.0%	77.8%	74.2%	78.0%	76.5%	80.0%	85.7%	82.0%	
		Pork Chops			234	259	279	309	297	252	257	251	
		Chickens	68.4%	61.6%	58.6%	52.2%	50.3%	48.9%	49.0%	40.2%	47.4%	49.1%	
91	78	77	52	75	56	60	62						
30.9%	25.1%	22.8%	16.5%	25.4%	21.9%	24.0%	18.6%						
91	78	77	52	75	56	60	62						
52.7%	46.3%	56.0%	45.9%	52.7%	50.0%	54.8%	46.9%						
97	101	130	94	96	76	80	69						
68.4%	61.6%	58.6%	52.2%	50.3%	48.9%	49.0%	40.2%	47.4%	49.1%				
195	1226	1231	713	853	1092	665	607	467	431				

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

Multidrug Resistance

Table 61a. Resistance Patterns among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2009

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Chicken Breasts			282	396	400	393	418	299	306	315
	Ground Turkey			304	333	376	396	388	315	300	306
	Ground Beef			295	311	338	316	295	256	250	247
	Pork Chops			184	218	232	205	182	152	146	147
	Chickens	285	1989	2100	1365	1697	2232	1357	1510	986	877
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	34.3% 108
	Ground Turkey			16.8% 51	14.7% 49	19.1% 72	16.2% 64	16.0% 62	13.0% 41	8.3% 25	11.8% 36
	Ground Beef			63.1% 186	66.9% 208	73.1% 247	80.4% 254	71.5% 211	77.0% 197	73.2% 183	78.1% 193
	Pork Chops			41.3% 76	44.5% 97	37.9% 88	48.8% 100	42.9% 78	48.0% 73	43.8% 64	51.0% 75
	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	21.9% 192
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	37.5% 118
	Ground Turkey			55.6% 169	55.6% 185	51.9% 195	52.6% 209	55.2% 214	57.5% 181	63.7% 191	66.3% 203
	Ground Beef			10.2% 30	7.4% 23	10.4% 35	5.4% 17	11.5% 34	9.0% 23	11.2% 28	6.9% 17
	Pork Chops			17.4% 32	17.9% 39	21.1% 49	16.1% 33	15.9% 29	15.1% 23	17.8% 26	15.0% 22
	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	41.4% 363
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	13.7% 43
	Ground Turkey			23.0% 70	30.0% 100	24.5% 92	24.2% 96	25.8% 100	27.0% 85	32.3% 97	38.9% 119
	Ground Beef			1.7% 5	4.2% 13	4.7% 16	1.9% 6	5.8% 17	4.7% 12	4.4% 11	3.6% 9
	Pork Chops			5.4% 10	6.9% 15	7.8% 18	4.9% 10	7.7% 14	3.3% 5	7.5% 11	10.9% 16
	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	14.5% 127
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	6.4% 20
	Ground Turkey			9.2% 28	14.7% 49	6.9% 26	6.3% 25	5.7% 22	4.1% 13	6.3% 19	7.8% 24
	Ground Beef			0.3% 1	2.6% 8	2.7% 9	1.0% 3	2.4% 7	0.4% 1	2.0% 5	1.2% 3
	Pork Chops			3.3% 6	2.8% 6	2.2% 5	1.5% 3	3.3% 6	1.3% 2	4.1% 6	5.4% 8
	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	7.5% 66
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	0.6% 2
	Ground Turkey			0.0% 0	2.7% 9	0.5% 2	1.8% 7	0.8% 3	1.9% 6	2.0% 6	2.3% 7
	Ground Beef			0.3% 1	1.0% 3	1.5% 5	0.6% 2	0.3% 1	0.4% 1	0.0% 0	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	2.0% 3
	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	0.2% 2

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

Table 61b. Resistance Patterns among *E. coli* Isolates from Retail Meats and Chickens, by Year, 2000-2009

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Isolates Tested	Chicken Breasts			282	396	400	393	418	299	306	315
	Ground Turkey			304	333	376	396	388	315	300	306
	Ground Beef			295	311	338	316	295	256	250	247
	Pork Chops			184	218	232	205	182	152	146	147
	Chickens	285	1989	2100	1365	1697	2232	1357	1510	986	877
Resistance Pattern	Isolate Source										
6. At Least ACT/S¹ Resistant	Chicken Breasts			0.0%	0.0%	0.3%	0.0%	0.0%	0.3%	0.0%	0.0%
				0	0	1	0	0	1	0	0
	Ground Turkey			0.0%	0.9%	0.0%	0.8%	0.3%	0.3%	0.0%	0.3%
				0	3	0	3	1	1	0	1
	Ground Beef			0.0%	0.0%	0.0%	0.3%	0.3%	0.0%	0.0%	0.0%
			0	0	0	1	1	0	0	0	
Pork Chops			0.5%	0.0%	0.4%	0.5%	0.0%	0.0%	0.0%	0.7%	
			1	0	1	1	0	0	0	1	
Chickens	1.4%	0.6%	0.3%	0.2%	0.3%	0.3%	0.2%	0.3%	0.3%	0.2%	
	4	11	7	3	5	7	3	4	3	2	
7. At Least ACSSuTAuCx² Resistant	Chicken Breasts			0.4%	0.0%	1.0%	0.3%	1.0%	0.7%	0.7%	0.6%
				1	0	4	1	4	2	2	2
	Ground Turkey			0.0%	0.3%	0.0%	0.3%	0.0%	1.3%	1.3%	1.0%
				0	1	0	1	0	4	4	3
	Ground Beef			0.0%	0.0%	0.9%	0.3%	0.0%	0.0%	0.0%	0.0%
			0	0	3	1	0	0	0	0	
Pork Chops			0.0%	0.5%	0.4%	0.0%	0.0%	0.7%	0.7%	2.0%	
			0	1	1	0	0	1	1	3	
Chickens	2.8%	1.1%	0.8%	0.8%	0.6%	0.5%	1.0%	0.9%	0.4%	0.2%	
	8	22	17	11	10	11	13	14	4	2	
8. At Least Ceftriaxone and Nalidixic Acid Resistant	Chicken Breasts			0.7%	0.5%	1.5%	0.3%	0.2%	0.0%	1.0%	1.0%
				2	2	6	1	1	0	3	3
	Ground Turkey			0.3%	0.3%	0.3%	0.3%	0.0%	0.6%	0.0%	0.0%
				1	1	1	1	0	2	0	0
	Ground Beef			0.0%	0.0%	0.3%	0.3%	0.3%	0.0%	0.0%	0.4%
			0	0	1	1	1	0	0	1	
Pork Chops			0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
			1	0	0	0	0	0	0	0	
Chickens	1.4%	0.3%	0.4%	0.9%	0.4%	0.7%	0.4%	0.6%	0.4%	0.6%	
	4	5	9	12	7	16	5	9	4	5	

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

² ACSSuTAuCx = ACSSuT, amoxicillin-clavulanic acid, and ceftriaxone

Appendix A

Table A1. Concentration Ranges Used for Susceptibility Testing of *Salmonella* and *E. coli*, 2009

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*, 2009

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, 1996-2009 ^{1,2}

Antimicrobial Class	Method	Broth Microdilution													
	Sensititre® Plate Name	CMV1CCDC ³	CMV3CNCD			CMV4CNCD	CMV5CNCD	CMV6CNCD	CMV7CNCD		CMV1AGNF				
	Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	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, 1997-2009 ¹

Antimicrobial Class	Method	E-Test [®]									Broth Microdilution Sensititre [®] Plate: CAMPY				
	Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
	Antimicrobial Agent														
Aminoglycosides	Gentamicin		√	√	√	√	√	√	√	√	√	√	√	√	
Ketolides	Telithromycin									√	√	√	√	√	
Lincosamides	Clindamycin	√	√	√	√	√	√	√	√	√	√	√	√	√	
Macrolides	Azithromycin		√	√	√	√	√	√	√	√	√	√	√	√	
	Erythromycin	√	√	√	√	√	√	√	√	√	√	√	√	√	
Penems	Meropenem														
Phenicols	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, 2002-2009

Antimicrobial Class	Method						Agar Dilution		Broth Microdilution Sensititre [®] Plate: CAMPY					
	Year						2002	2003	2004	2005	2006	2007	2008	2009
	Antimicrobial Agent													
Aminoglycosides	Gentamicin						√	√	√	√	√	√	√	√
Ketolides	Telithromycin								√	√	√	√	√	√
Lincosamides	Clindamycin								√	√	√	√	√	√
Macrolides	Azithromycin								√	√	√	√	√	√
	Erythromycin						√	√	√	√	√	√	√	√
Penems	Meropenem						√	√						
Phenicols	Chloramphenicol													
	Florfenicol								√	√	√	√	√	√
Quinolones	Ciprofloxacin						√	√	√	√	√	√	√	√
	Nalidixic acid								√	√	√	√	√	√
Tetracyclines	Doxycycline						√	√						
	Tetracycline								√	√	√	√	√	√