NARMS

National Antimicrobial Resistance Monitoring System

Food and Drug Administration • Centers for Disease Control and Prevention • United States Department of Agriculture

2010

Animal Arm Annual Report

BEAR

Bacterial Epidemiology and Antimicrobial Resistance

USDA

ars

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I. Introduction

In an effort to prospectively monitor the emergence of antimicrobial resistance in zoonotic pathogens, the National Antimicrobial Resistance Monitoring System (NARMS) was established in 1996 by the Food and Drug Administration's Center for Veterinary Medicine in collaboration with the Centers for Disease Control and Prevention, and the United States Department of Agriculture (USDA).

The animal component of NARMS is housed within the Bacterial Epidemiology and Antimicrobial Resistance Research Unit (BEAR) of the USDA's Agricultural Research Service in Athens, Georgia. For this report, the animal component of NARMS comprises the testing of isolates obtained from food-producing animals at slaughter through the USDA Food Safety and Inspection Service (FSIS) Pathogen Reduction: Hazard Analysis and Critical Control Point (PR/HACCP) verification testing program.

The antimicrobial agents selected for study are representative of antimicrobials used in both human and veterinary medicine and are selected primarily based on therapeutic value although molecular mechanisms of resistance or treatment patterns may also influence selection. Non-Typhi *Salmonella* was chosen as a sentinel organism of the NARMS program. Testing of *Campylobacter, Escherichia coli* and *Enterococcus* isolates from animals began in 1998, 2000 and 2003, respectively.

This report summarizes 2010 data for *Salmonella*, *Campylobacter*, *E. coli* and *Enterococcus* isolates from food-producing animals at slaughter (chicken, turkey, cattle, and swine). Resistance data for previous years is included; however, due to the amount of data and complexity of analyses involved, all permutations are not represented. Additional information on the animal component of NARMS including past annual reports, summary trend tables and graphs, as well as a component for interactive data analysis can be found on the USDA's NARMS web page (http://www.ars.usda.gov/saa/bear/narms). Other analyses are available upon request.

Suggested Citation: USDA. National Antimicrobial Resistance Monitoring System – Enteric Bacteria, Animal Arm (NARMS): 2010 NARMS Animal Arm Annual Report. Athens, GA: U.S. Department of Agriculture, Agricultural Research Service, 2012.

The 2009 NARMS Executive Report contains additional background information on sampling and testing methodology for the human and retail arms of NARMS as well as summary data from all three components.

II. Sampling and Testing Methods

A. Samples

The *Salmonella* isolates included in this report were recovered by FSIS from carcass rinsates (chickens), carcass swabs (turkeys, cattle, and swine), and ground products (chickens, turkeys, and beef).

Campylobacter, E. coli and *Enterococcus* isolates included in this report were recovered by BEAR from FSIS Eastern Lab carcass rinsates (chickens).

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 samples were collected randomly from eligible federally inspected establishments, with a goal of scheduling every eligible establishment at least once a year. Targeted samples were collected from establishments that had a previously failed sample set. Beginning in June of 2006, sampling 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.[1,2] Once the establishments presenting the greatest risk are sampled, FSIS prioritizes sampling at the establishments that have not been sampled within the last two years.

B. Isolation and Identification

1. *Salmonella*: Isolation from slaughter samples was conducted by FSIS at all three FSIS Regulatory Field Services Laboratories [Eastern (Athens, GA), Midwestern (St. Louis, MO) and Western (Alameda, CA)] following the "Isolation and Identification of *Salmonella* from Meat, Poultry, and Egg" procedures as described in the Microbiology Laboratory Guidebook, section 4.[3,4] Each FSIS laboratory processes samples collected throughout the U.S. Isolates were forwarded by FSIS to the National Veterinary Services Laboratories, Ames, IA (NVSL) for serotyping and a duplicate isolate was sent to BEAR for susceptibility testing and Pulsed Field Gel Electrophoresis (PFGE). Serotype results were subsequently sent to the BEAR unit as they became available.

2. *Campylobacter*: From 1998 to 2000, *Campylobacter* was isolated by all FSIS laboratories as part of the chicken monitoring baseline programs using the method described in the FSIS Microbiology Laboratory Guidebook.[5] Following presumptive identification, isolates were sent to BEAR for final confirmation and susceptibility testing as described below. Upon review of susceptibility data and isolation methods, it was determined that use of nalidixic acid as part of the culture selection criteria may have resulted in recovery of isolates more likely to be resistant to quinolones. A comparative study was initiated by BEAR in 2001.

[1] USDA/FSIS. 2008. Serotypes Profile of Salmonella Isolates from Meat and Poultry Products. Available at http://www.fsis.usda.gov/Science/Serotypes_Profile_Salmonella_Isolates/index.asp.
[2] USDA/FSIS. FSIS Scheduling Criteria for Salmonella Sets in Raw Classes of Product. Available at http://www.fsis.usda.gov/PDF/Scheduling_Criteria_Salmonella_Sets.pdf.
[3] USDA/FSIS. 2004. Isolation and Identification of *Salmonella* from Meat, Poultry, and Egg Products. Microbiological Lab Guidebook 4.03. Available at http://www.fsis.usda.gov/PDF/MLG_4_03.pdf.
[4] USDA/FSIS. 2010. Laboratories and Procedures. Available a.t http://www.fsis.usda.gov/Science/Laboratories_&_Procedures/index.asp.
[5] USDA/FSIS. 1998. Isolation, Identification, And Enumeration Of Campylobacter jejuni/coli From Meat And Poultry Products. Microbiology Laboratory Guidebook, chapter 6. Available at http://www.fsis.usda.gov/ophs/Microlab/Mlgchp6.pdf.

For the first half of 2001, BEAR pilot tested several isolation methods for *Campylobacter* prior to adopting a new method in July. Since that time, only rinsates from the FSIS Eastern Lab containing $\geq$ 10 ml have been used. Thus, all rinsates tested for *Salmonella* were not processed for *Campylobacter*, *E. coli* or *Enterococcus*. Also important to note is that when the FSIS *Campylobacter* baseline testing ended in 2000, rinsates were no longer temperature controlled during shipment which may have affected isolate recovery. For *Campylobacter* isolation, 10 mls of rinsate was enriched in an equal volume of Campylobacter Enrichment Broth without blood under microaerobic conditions for 48 h at 42°C. Aliquots were struck onto Campy Cefex agar and plates were incubated as above. Final confirmation and speciation of *Campylobacter* isolates were obtained using the BAX® System Q7 (DuPont Qualicon; Wilmington, DE). This real-time PCR assay is able to detect *C. coli*, *C. jejuni*, and *C. lari* and was performed according to manufacturer's directions.

3. *Escherichia coli*: BEAR started isolating generic *E. coli* from the same rinsates used for *Campylobacter* isolation in 2000. A sample of the rinsate was enriched overnight before streaking onto a CHROMAgar™ ECC plate (DRG International; Mountainside, NJ). Plates were incubated at 36°C ± 1°C for 18-24 h as described by the manufacturer. Blue-green colonies, typical of generic *E. coli,* were selected for susceptibility testing and confirmed as *E. coli* using the Vitek (bioMérieux, Inc; Durham, NC).

4. *Enterococcus*: In 2003, isolation of Enterococcus began using the same rinsates used for *Campylobacter* and *E. coli* isolation. An aliquot of each rinsate was enriched for 48 h at 37°C in Enterococcosel broth. Aliquots were taken from enriched broths exhibiting a color change and struck to Enterococcosel agar which was then incubated overnight at 37°C.

A species-specific multiplex PCR was performed on presumptive *Enterococcus* isolates which provided a simultaneous genus and species identification of 23 species of enterococci.[6] Confirmed *Enterococcus* isolates of other species not identified with this procedure were labeled as *'Enterococcus* species*'.*

C. Antimicrobial Susceptibility

In 2010, *Salmonella*, *Campylobacter*, *E. coli* and *Enterococcus* were tested using a semi-automated broth microdilution system (Sensitire®, Trek Diagnostic Systems, Inc., Westlake, Ohio) and a custom made 96-well panel of antimicrobials (catalog no. CMV1AGNF for *Salmonella* and *E. coli;* catalog no. CAMPY for *Campylobacter* and catalog no. CMV3AGPF for *Enterococcus*) to determine the minimum inhibitory concentration (MIC) of antimicrobials important in both human and veterinary medicine. Tables 1, 2 and 3 list the antimicrobials tested, including the breakpoints for *Salmonella*/*E. coli*, *Campylobacter*, and *Enterococcus*, respectively. From 1998-2004, MICs for *Campylobacter* isolates were determined using Etest® (AB Biodisk; Solna, Sweden) as per manufacturer's direction with the exception that MICs were not rounded up prior to categorization. In 2005, the animal arm of NARMS switched to using the Sensititre® broth microdilution system for *Campylobacter*.[7]

[6] Jackson, C. 2004. Use of a Genus- and Species-Specific Multiplex PCR for Identification of *Enterococci*. Journal of Clinical Microbiology, *42*(8):3558-65
[7] 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

Regardless of the susceptibility testing method used, antimicrobial resistance was determined using Clinical and Laboratory Standards Institute (CLSI) breakpoints, when available.[8,9,10]

For antimicrobial agents without CLSI approved breakpoints, interpretive criteria established by the NARMS working group were used.

Quality control strains used for *Salmonella* and *E. coli* susceptibility testing included *E. coli* ATCC 25922, *Enterococcus faecalis* ATCC 29212, *Pseudomonas aeruginosa* ATCC 27853 and *Staphylococcus aureus* ATCC 29213. *Campylobacter jejuni* ATCC 33560 was used as a control for *Campylobacter* susceptibility testing. For *Enterococcus* testing, *Enterococcus faecalis* ATCC 29212 and ATCC 51299 were used.

[8] 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.
[9] 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.
[10] CLSI. 2011. Performance Standards for Antimicrobial Susceptibility Testing; Twenty-first Informational Supplement. CLSI document M100-S21. CLSI, Wayne, PA.

Table 1. *Salmonella* and *E. coli* Interpretive Criteria (breakpoints)[11]

CLSI Antimicrobial Class[12]	Antimicrobial Agent	Breakpoints (µg/ml)		
		Susceptible	Intermediate	Resistant
Aminoglycosides	Amikacin	≤ 16	32	≥ 64
	Gentamicin	≤ 4	8	≥ 16
	Kanamycin	≤ 16	32	≥ 64
	Streptomycin[13]	≤ 32	Not Applicable	≥ 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
	Cephalothin	≤ 8	16	≥ 32
Folate Pathway Inhibitors	Sulfonamides[14]	≤ 256	Not Applicable	≥ 512
	Trimethoprim–Sulfamethoxazole	≤ 2 / 38	Not Applicable	≥ 4 / 76
Penicillins	Ampicillin	≤ 8	16	≥ 32
Phenicols	Chloramphenicol	≤ 8	16	≥ 32
Quinolones	Ciprofloxacin	≤ 1	2	≥ 4
	Nalidixic acid	≤ 16	Not Applicable	≥ 32
Tetracyclines	Tetracycline	≤ 4	8	≥ 16

[11] Breakpoints established by CLSI (Clinical and Laboratory Standards Institute) were used when available.
[12] According to CLSI M100 document
[13] There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS
[14] From 1997 through 2003, sulfamethoxazole was tested. Sulfisoxazole replaced sulfamethoxazole beginning in 2004

Table 2. *Campylobacter* Interpretive Criteria (breakpoints)[15]

CLSI Antimicrobial Class[16]	Antimicrobial Agent	Breakpoints (µg/ml) Etest (1998-2004)			Breakpoints (µg/ml) Broth Microdilution (2005-2010)		
		Susceptible	Intermediate	Resistant	Susceptible	Intermediate	Resistant
Aminoglycosides	Gentamicin	≤ 4	8	≥ 16	≤ 2	4	≥ 8
Lincosamides	Clindamycin	≤ 0.5	1 - 2	≥ 4	≤ 2	4	≥ 8
Macrolides	Azithromycin	≤ 0.25	0.5 - 1	≥ 2	≤ 2	4	≥ 8
	Erythromycin	≤ 0.5	1 - 4	≥ 8	≤ 8	16	≥ 32
Ketolides	Telithromycin	Not Tested	Not Tested	Not Tested	≤ 4	8	≥ 16
Phenicols	Florfenicol	Not Tested	Not Tested	Not Tested	≤ 4	Not Applicable	Not Applicable
	Chloramphenicol	≤ 8	16	≥ 32	Not Tested	Not Tested	Not Tested
Fluoroquinolones	Ciprofloxacin	≤ 1	2	≥ 4	≤ 1	2	≥ 4
Quinolones	Nalidixic acid	≤ 16	Not Applicable	≥ 32	≤ 16	32	≥ 64
Tetracyclines	Tetracycline	≤ 4	8	≥ 16	≤ 4	8	≥ 16

[15] Breakpoints established by CLSI (Clinical and Laboratory Standards Institute) were used when available. CLSI breakpoints are available only for erythromycin, ciprofloxacin, and tetracycline. All other breakpoints were established by NARMS
[16] According to CLSI M100 document

Table 3. *Enterococcus* Interpretive Criteria (breakpoints)[17]

CLSI Subclass[18]	Antimicrobial Agent	Breakpoints (µg/ml)		
		Susceptible	Intermediate	Resistant
Aminoglycoside[19]	Gentamicin	≤ 500	N/A	> 500
	Kanamycin	≤ 512	N/A	≥ 1024
	Streptomycin	≤ 1000	N/A	> 1000
Glycopeptide	Vancomycin	≤ 4	8 - 16	≥ 32
Glycylcycline	Tigecycline[20]	≤ 0.25	N/A	N/A[4]
Lincosamides	Lincomycin	≤ 2	4	≥ 8
Lipopeptide	Daptomycin[21]	≤ 4	N/A	N/A[5]
Macrolide	Erythromycin	≤ 0.5	1 - 4	≥ 8
	Tylosin	≤ 8	16	≥32
Nitrofuran	Nitrofurantoin	≤ 32	64	≥128
Oxazolidinones	Linezolid	≤ 2	4	≥ 8
Penicillin	Penicillin	≤ 8	N/A	≥ 16
Phenicol	Chloramphenicol	≤ 8	16	≥ 32
Phosphoglycolipid	Flavomycin	≤ 8	16	≥ 32
Quinolone	Ciprofloxacin	≤ 1	2	≥ 4
Streptogramin	Quinupristin/Dalfoprisitin	≤ 1	2	≥ 4
Tetracycline	Tetracycline	≤ 4	8	≥ 16

D. Phage Typing

Salmonella Typhimurium and *S.* Typhimurium variant 5- isolates with resistance to at least ampicillin, chloramphenicol, sulfisoxazole and tetracycline (ACSuT) were submitted to NVSL for phage typing.

[17] Breakpoints established by CLSI (Clinical and Laboratory Standards Institute) were used when available. CLSI breakpoints are not available for Kanamycin, Lincomycin, Tylosin and Flavomycin and were established by NARMS
[18] According to CLSI M100 document
[19] For the aminoglycosides, breakpoints refer to high-level aminoglycoside resistance
[20] For Tigecycline, only a susceptible breakpoint (≤0.25 µg/ml) has been established. In this report, isolates with an MIC ≥0.5 µg/ml are categorized as resistant
[21] For Daptomycin, only a susceptible breakpoint (≤4 µg/ml) has been established. In this report, isolates with an MIC ≥8 µg/ml are reported as resistant

III. Reporting Methods

WHONET 5, a free microbiology laboratory database software program, was used to categorize MICs as resistant, intermediate (when applicable), and susceptible according to CLSI established interpretive criteria (when available). The 95% confidence interval was calculated using the Wilson interval with continuity correction method in WHONET 5. Resistance percentages by food animal source and organism are presented from 1997 through 2010 for *Salmonella*, from 1998 through 2010 for *Campylobacter*, from 2000 through 2010 for *E. coli* and from 2003 through 2010 for *Enterococcus*. It should be noted that *Enterococcus* data has not been reported since 2006. Since then, antimicrobial susceptibility analysis has been completed on additional isolates not previously tested in 2003-2006. Hence, a difference in the number of isolates tested can be observed for years 2003 through 2006 when compared to the last reported *Enterococcus* results and some differences in susceptibility testing may be observed.

MIC distributions are presented for 2010. For *Salmonella*, MIC distributions were tabulated on both macro and micro levels. At the macro level, all *Salmonella* serotypes were combined and analyzed for MIC distributions. At the micro level, isolates were grouped by serotype prior to analysis. Results were tabulated for the top serotypes from chickens, turkeys, cattle, and swine. MIC distributions were tabulated separately for *C. coli* and *C. jejuni*. For *Enterococcus*, MIC distributions were calculated separately for each of the top species. The change in sample collection methods by FSIS in 2006 limits meaningful trend comparison between pre-2006 and post-2006. Similarly, these changes limit year-to-year comparisons post-2006.[22]

In this report, multiple drug resistance (MDR) is reported as resistance to more than one antimicrobial class (i.e. multiple antimicrobials may be included in a class and resistance to any one antimicrobial within a class results in the designation of the class being resistant).

The antimicrobial classes used for MDR tabulations for *Salmonella* and *E. coli* were aminoglycosides (amikacin, gentamicin, kanamycin and streptomycin), β-lactam/β-lactamase inhibitor combinations (amoxicillin-clavulanic acid), cephems (cefoxitin, ceftiofur and ceftriaxone), penicillins (ampicillin), folate pathway inhibitors (sulfonamides and trimethoprim/sulfamethoxazole), phenicols (chloramphenicol), quinolones (ciprofloxacin and nalidixic acid), and tetracyclines (tetracycline). The antimicrobial classes used for MDR tabulations for *Campylobacter* were aminoglycosides (gentamicin), ketolides (telithromycin 2005-2009), lincosamides (clindamycin), macrolides (azithromycin and erythromycin), phenicols (chloramphenicol 1998-2004 and florfenicol 2005-2009), quinolones (ciprofloxacin and nalidixic acid) and tetracyclines (tetracycline). The antimicrobial classes used for MDR tabulations for *Enterococcus* were aminoglycosides (gentamicin, kanamycin and streptomycin), glycopeptides (vancomycin), glycylcylines (tigecycline 2006-2010), lincosamides (lincomycin), lipopeptides (daptomycin 2004-2010), macrolides (erythromycin and tylosin), nitrofurans (nitrofurantoin), oxazolidinones (linezolid), penicillins (penicillin), phenicols (chloramphenicol), phosphoglycolipid (flavomycin),

[22] USDA/FSIS. 2008. Serotypes Profile of Salmonella Isolates from Meat and Poultry Products. Available at http://www.fsis.usda.gov/Science/Serotypes_Profile_Salmonella_Isolates/index.asp.

quinolones (ciprofloxacin), streptogramins (quinupristin/dalfopristin), and tetracyclines (tetracycline). Where appropriate, antimicrobials are reported by class in all tables for ease of analysis.

IV. Data Analysis

A. *Salmonella*

1. Recovery of isolates by serotype within commodity

The total number of *Salmonella* isolates tested by year since 1997 is shown in Table 1A.

The top serotypes by commodity for 2010 are shown in Table 2A. Overall, Kentucky, Hadar, Montevideo and Derby ranked as the most prevalent serotype for chickens, turkeys, cattle and swine, respectively. Using 2010 serotypes as the baseline, the relative distributions from 1997-2010 for the top five serotypes per commodity are shown in Figures 1A-4A.

Since 2002, the percentage distribution of Kentucky and Heidelberg from chickens appears divergent (Figure 1A). While an upward trend in Kentucky was observed from 1997 through 2006, a downward trend was observed predominantly for Heidelberg during the same time period. Kentucky declined from 2006 to 2008 before increasing again in 2009 (38.8%) and in 2010 (43.1%). At the same time an increase in Heidelberg was observed from 2006 to 2008 before declining in 2009 (13.4%) and 2010 (4.4%). Since 2002, recovery of Enteritidis has increased to 27.0% of isolates in 2010. Conversely, recovery of Typhimurium and Typhimurium variant 5- has remained at or below 8.7% for all years.

Among isolates recovered from turkeys (Figure 2A) Hadar remained below 18.5% through 2004, increased in 2007 to 43.5%, and has since declined to 19.9% in 2010. The recovery of Saintpaul fluctuated between 0.9% in 1997 and 13.9% in 2010. In general, a steady decline was observed in Heidelberg from 2001 (25.8%) through 2009 (2.5%); however an increase was observed in 2010 (9.3%). Both Senftenberg and antigenic formula III 18:z4,z23:- have remained at or below 9.5% of isolates for all years.

In 2010, the recovery of Montevideo among cattle isolates decreased to 24.7% after a steady incline from 2005 (13.1%) to 2009 (29.5%). With the exception of 2005, Dublin has shown an upward trend from 2005 to 2010 (from 3.6% to 16.6%). Recovery of Anatum, Kentucky and Typhimurium has remained at or below 10.9% since 1998 (Figure 3A).

Recovery of Derby among swine has fluctuated within the years tested from a high of 34.3% in 2002 to a low of 12.3% in 2007. However, a decline has been observed in 2009 (20.0%) and in 2010 (16.2%) (Figure 4A). An increase in Saintpaul was observed in 2010 (9.9%) and represents the highest percent recovered to date. Variations were noted for recovery of Infantis, Johannesburg and Typhimurium variant 5- from 1997-2010, but overall remained at or below 16.2%.

2. MIC distributions

The 2010 MIC distributions by antimicrobial and commodity for all *Salmonella* serotypes combined (macro analysis) are shown in Table 3A. Since it is not unusual for resistance to be driven by only a few serotypes and because the distribution of serotypes between commodities varies greatly, it is important to determine resistance at the serotype and commodity level (micro analysis). However, a macro analysis is often useful to quickly determine any overt change between years prior to conducting a micro analysis of the data.

The overall percent resistance by year (macro analysis), antimicrobial and commodity of all *Salmonella* serotypes combined is shown in Table 4A. Resistance to amikacin has only been observed once in a single isolate from swine in 2007. Similarly, with the exception of one isolate from chicken in 2003, resistance has yet to emerge to ciprofloxacin. However, a breakpoint change for ciprofloxacin for invasive *Salmonella* was recently published in the latest CLSI M100 document (January 2012).[23] Appendix A shows MIC distributions by commodity for all years and percent resistance as calculated with the new lower MIC interpretation breakpoints. A total of only nine additional isolates among all years were classified as ciprofloxacin resistant using the new lower breakpoint (chickens n=3, turkeys n=5, and cattle n=1). Resistance to nalidixic acid remained at or below 0.7% for chickens, turkeys and swine, however, increased from 1.0% to 2.8% among cattle in 2010 and is primarily attributed to an increase in serotype Dublin. Resistance to gentamicin among turkeys increased from 14.9% to 19.9% in 2010 and remains highest among turkeys when compared to other animal sources (not attributed to a particular serotype). In 2010, resistance to the cephems class remained highest among cattle isolates (20.6%, 21.5% and 21.5% for cefoxitin, ceftiofur and ceftriaxone, respectively); additionally, these numbers show an increase from 2009. An increase in resistance to the cephems class was also observed among turkeys from 2009 to 2010; conversely, a decrease in cephem resistance was observed in swine. Ampicillin resistance among turkeys in 2010 (44.4%) has been the highest observed among all commodities and years. Likewise in 2010, resistance to amoxicillin/clavulanic acid increased among turkeys and cattle (15.2% and 21.5%, respectively) and has been the highest observed among all years in each commodity. In 2010, resistance to trimethoprim/sulfamethoxazole was only observed in cattle and swine (4.5% and 1.8%, respectively). Resistance to the other antimicrobials varied by commodity.

A micro analysis of the 2010 data is presented in Tables 5A through 8A which shows total percent resistance and MIC distribution by commodity and serotypes. Data is only presented for those serotypes with at least ten isolates in a particular commodity. Among serotypes from *Salmonella* isolates recovered from chickens (Table 5A), Kentucky (n=243) exhibited varying levels and combinations of resistance to 10 antimicrobials (amoxicillin/clavulanic acid, ampicillin, cefoxitin, ceftiofur, ceftriaxone, chloramphenicol, gentamicin, streptomycin, sulfisoxazole and tetracycline) and showed no resistance to five antimicrobials (amikacin, ciprofloxacin, kanamycin and nalidixic acid trimethoprim/sulfamethoxazole). Conversely, Enteritidis (n=152) was susceptible to amoxicillin/clavulanic acid and to the cephems class while exhibiting $\leq$ 3.3% resistance to all other antimicrobials tested. A contrast in resistance levels among serotypes from *Salmonella* isolates recovered from turkeys is also observed (Table 6A). Hadar (n=30) was susceptible to all antimicrobials

[23] CLSI. 2012. Performance Standards for Antimicrobial Susceptibility Testing; Twenty-second Informational Supplement. CLSI document M100-S22. CLSI, Wayne, PA.

from the cephems class while 35.7% of Heidelberg (n=14) were resistant. Among cattle (Table 7A), Montevideo (n=61) only exhibited resistance to streptomycin (3.3%) and tetracycline (11.5%). Conversely, Dublin (n=41) was resistant to 13 antimicrobials tested and was only susceptible to amikacin and ciprofloxacin.

The frequency and percentage of confirmed *S.* Typhimurium classified as definitive type (DT) 104 and DT104 complex isolates (DT104a, DT104b or U302) is reported separately by food animal source from 1997 through 2010 (Table 9A). In 2010, DT104 isolates were identified among *S*. Typhimurium recovered from cattle (n=5), swine (n=5), turkeys (n=2) and chickens (n=1). In 2010, a total of 13 isolates were confirmed as DT104 or DT104 complex which accounted for 15.1% of all *S*. Typhimurium and *S*. Typhimurium variant 5- isolates tested and for 1.2% of all *Salmonella* (n=1,073) tested in 2010. In previous years, results were presented separately for isolates exhibiting the ACSSuT (ampicillin, chloramphenicol, streptomycin, sulfisoxazole and tetracycline) penta-resistant pattern and the ACSuT quad-resistant pattern; however in 2010, there were no Typhimurium or Typhimurium var. 5- isolates exhibiting the latter pattern.

Specific MDR patterns by commodity are presented in Tables 10A through 13A. Data is presented by CLSI class as well as by phenotype(s) thought to be of clinical importance in humans [at least ACSSuT, ACT/S (ampicillin, chloramphenicol, trimethoprim/sulfamethoxazole), ACSSuTAuCx [ACSSuT, amoxicillin/clavulanic acid and ceftriaxone] or ceftriaxone and nalidixic acid resistance]. Overall, pan-susceptible isolates most often originated (in order of decreasing frequency) from cattle, chickens, swine and turkeys as observed in previous years. Among the clinically important phenotypes reported, resistance was least often observed to ACT/S and to ceftriaxone plus nalidixic acid for all animal sources. Isolates with resistance to phenotypes ACSSuT and ACSSuTAuCx most often originated from cattle (18.6% and 16.2%, respectively in 2010).

B. *Campylobacter*

The number of *Campylobacter* isolates tested from chicken rinsates is shown in Table 1B. *Campylobacter jejuni* were more frequently recovered than *C. coli* for all report years. The distribution of *Campylobacter* species recovered from chicken remained stable from 1998 to 2008. After a decrease in *C. jejuni* from 2008 (73.6%) to 2009 (59.1%), an increase was observed from 2009 to 2010 (59.1% to 67.5%). Conversely, after an increase was observed in *C. coli* from 2008 (31.4%) to 2009 (40.9%), a decrease was observed from 2009 to 2010 (40.9% to 32.5%) (Figure 1B).

MIC distributions by antimicrobial and species are shown in Table 2B. No resistance to florfenicol was observed for either species. In 2010, resistance was higher for *C. coli* than *C. jejuni* for all drugs with the exception of ciprofloxacin and nalidixic acid. For both ciprofloxacin and nalidixic acid, *C*. jejuni resistance was 23.1% while *C*. coli was 22.0%.

Percent resistance by year, antimicrobial, and species are shown in Table 3B. Resistance to gentamicin in 2010 increased among *C. coli* to 5.0% and decreased among *C. jejuni* to 0.5%. Likewise, resistance to clindamicin among *C. coli* increased in 2010 to 4.0% whereas *C. jejuni* isolates continued to be susceptible. In 2010, resistance to the macrolides decreased in *C. coli* to 4.0% while *C. jejuni* isolates remained susceptible. Resistance to the quinolones in *C. coli* remained stable in 2010 following an increase observed in 2009. An increase in *C. jejuni* resistance to the quinolones was observed in 2010 to 23.1% for both ciprofloxacin and nalidixic acid. Tetracycline resistance increased in *C. coli* from 2009 to 2010 and decreased in *C. jejuni;* however, resistance to tetracycline in both species has generally remained stable.

MDR by CLSI class is presented in Tables 4B and 5B. Overall, MDR has been more frequently observed in *C. coli* than *C. jejuni.*

C. *Escherichia coli* (generic)

The number of *E. coli* isolates tested from chicken rinsates is shown in Table 1C. MIC distribution by antimicrobial is shown in Table 2C.

Percent resistance by year is shown in Table 3C. No resistance has been observed to amikacin from 1997 through 2010. Resistance to ciprofloxacin has remained below 0.6% since 1997. With the exception of ampicillin, cefoxitin and ceftriaxone, resistance in 2010 either decreased or remained stable for all other antimicrobials. In 2010, resistance increased to ampicillin (22.2%), cefoxitin (12.5%) and ceftriaxone (12.3%). Resistance in *E. coli* was highest to sulfisoxazole (51.8%), followed by streptomycin (49.1%) and tetracycline (42.9%).

MDR by CLSI class is presented in Table 4C. The percent of isolates that were pan-susceptible decreased in 2010 to 21.5% while resistance to ≥ 4 and ≥ 5 CLSI classes increased to 15.1% and 8.2%, respectively.

C. *Enterococcus*

The number of *Enterococcus* isolates tested from chicken rinsates is shown in Table 1D. As previously mentioned in Section III- Reporting Methods, the number of isolates tested from 2003-2006 has changed since the last publication of *Enterococcus* data. The top *Enterococcus* species tested are listed in Table 2D. The most frequent species were *E. faecalis* (44.3%), *E. faecium* (30.1%), *E. durans* (7.5%), *E. hirae* (5.9%) and *E. casseliflavus* (4.4%) (Figure 1D).

MIC distribution by antimicrobial and regardless of species is shown in Table 3D. Percent resistance by year is shown in Table 4D. No resistance has been observed to vancomycin or linezolid from 2003 through 2010. In 2010, *Enterococcus* isolates were also susceptible to tigecycline and chloramphenicol while only 0.6% were resistant to daptomycin. No significant variations in resistance to the macrolides occurred from 2009 to 2010, however there was an increase in nitrofurantoin (23.0%) and ciprofloxacin (11.2%) resistance which are the highest percentages observed since *Enterococcus* testing began in 2003.

MIC distributions for the top *Enterococcus* species are shown in Table 5D. Resistance to various antimicrobials was quite distinct between *E. faecalis* and *E. faecium*. Resistance to nitrofurantoin, penicillin and ciprofloxacin was ≥ 25.6% for *E. faecium* while resistance to these drugs was < 1.0% for *E. faecalis*. On the contrary, resistance to gentamicin, kanamycin, erythromycin and tylosin was higher among *E. faecalis* (≥ 34.8%) than *E. faecium* (≤ 21.4%).

MDR by CLSI class is presented in Table 6D and 7D for *E. faecalis* and *E. faecium*, respectively. MDR ($\geq$ 3, $\geq$ 4 and $\geq$ 5 CLSI classes) in *E. faecium* was higher than *E. faecalis*.

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VI. Results

A. *Salmonella*

Table 1A. Number of *Salmonella* Isolates Tested by Year and Animal Source, 1997-2010

Animal Source	Year													
	1997 n=456	1998 n=1878	1999 n=4637	2000 n=3530	2001 n=3168	2002 n=3131	2003 n=2301	2004 n=2431	2005 n=2846	2006 n=2377	2007 n=1915	2008 n=1326	2009 n=992	2010 n=1073
Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	564
Turkeys	107	240	713	518	550	244	262	236	227	304	271	148	121	151
Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443	200	247
Swine	111	793	876	451	418	379	211	308	301	304	211	111	120	111

Table 2A. Most Common Serotypes among *Salmonella* Isolates Tested, 2010

Animal Source	Rank	Serotype	n	%
Chickens (n=564)	1	Kentucky	243	43.1
	2	Enteritidis	152	27.0
	3	Typhimurium var. 5-	29	5.1
	4	Typhimurium	25	4.4
	5	Heidelberg	25	4.4
	6	I 4,5,12:i:-	11	2.0
	7	Johannesburg	8	1.4
	8	Schwarzengrund	6	1.1
	8	Berta	6	1.1
	8	4,12:i:-	6	1.1
	9	Montevideo	5	0.9
	9	Senftenberg	5	0.9
	9	Thompson	5	0.9
Subtotal			526	93.3
		Others	38	6.7
Total			564	100

Animal Source	Rank	Serotype	n	%
Turkeys (n=151)	1	Hadar	30	19.9
	2	Saintpaul	21	13.9
	3	Heidelberg	14	9.3
	4	Schwarzengrund	11	7.3
	4	III 18:z4,z23:-	11	7.3
	5	Muenchen	10	6.6
	6	Senftenberg	6	4.0
	6	Albany	6	4.0
	7	Newport	5	3.3
	7	Anatum	5	3.3
	7	Agona	5	3.3
Subtotal			124	82.1
		Others	27	17.9
Total			151	100

Animal Source	Rank	Serotype	n	%
Cattle (n=247)	1	Montevideo	61	24.7
	2	Dublin	41	16.6
	3	Kentucky	13	5.3
	4	Anatum	12	4.9
	5	Typhimurium	11	4.5
	6	Cerro	10	4.0
	7	Agona	8	3.2
	7	Mbandaka	8	3.2
	8	Meleagridis	7	2.8
	9	Senftenberg	5	2.0
	9	Newport	5	2.0
	9	Infantis	5	2.0
Subtotal			186	75.3
		Others	61	24.7
Total			247	100

Animal Source	Rank	Serotype	n	%
Swine (n=111)	1	Derby	18	16.2
	2	Saintpaul	11	9.9
	3	Typhimurium var. 5-	10	9.0
	4	Infantis	9	8.1
	5	Johannesburg	8	7.2
	6	Adelaide	7	6.3
	7	London	6	5.4
	8	Anatum	5	4.5
	8	Heidelberg	5	4.5
	9	Agona	4	3.6
Subtotal			83	74.8
		Others	28	25.2
Total			111	100

Figure 1A. Chickens- Serotype Percent Distribution by Year in Relation to Top Serotypes Identified in 2010

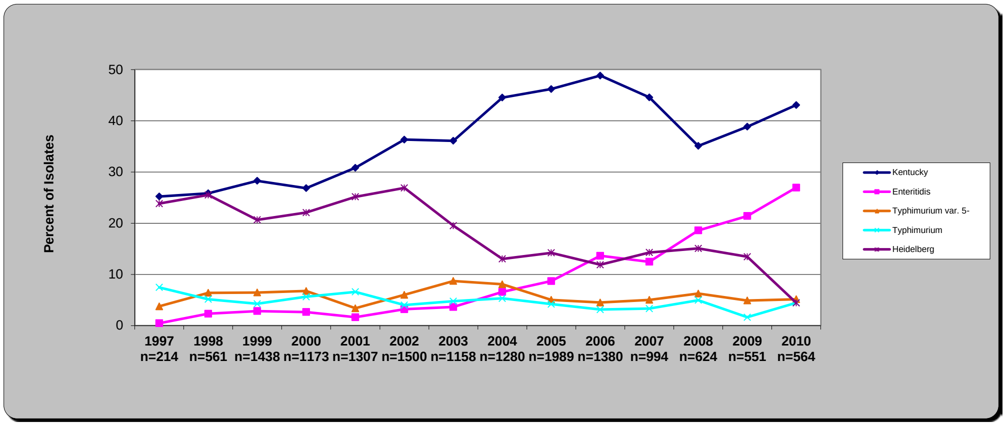
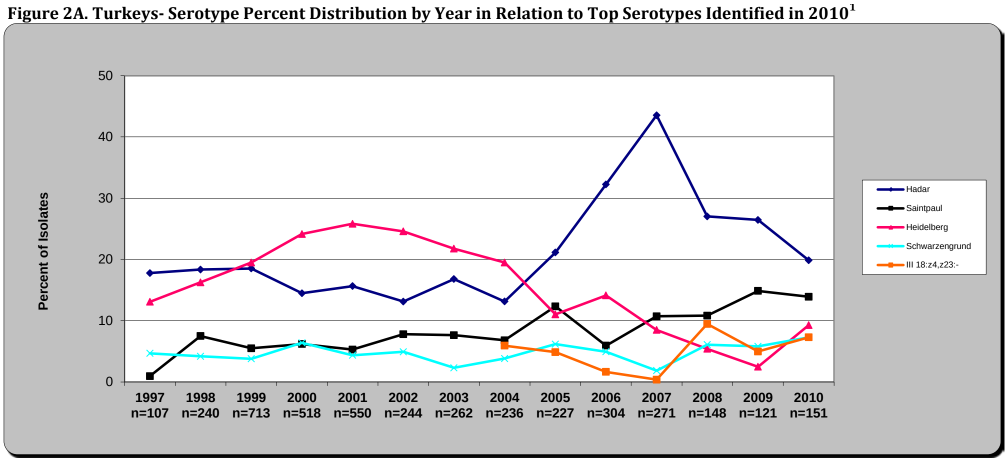


Figure 2A. Turkeys- Serotype Percent Distribution by Year in Relation to Top Serotypes Identified in 2010[1]



[1] Data are not available for III 18:z4,z23:- prior to 2004

Figure 3A. Cattle- Serotype Percent Distribution by Year in Relation to Top Serotypes Identified in 2010

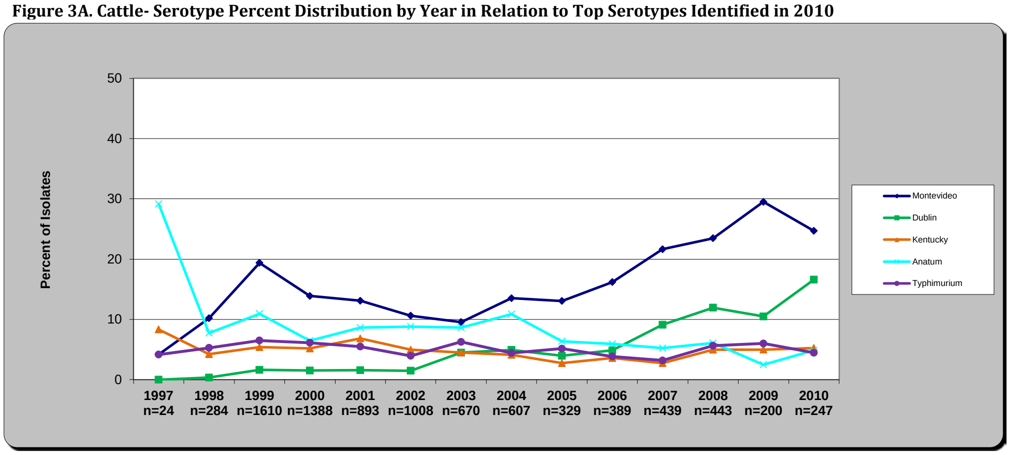


Figure 4A. Swine- Serotype Percent Distribution by Year in Relation to Top Serotypes Identified in 2010

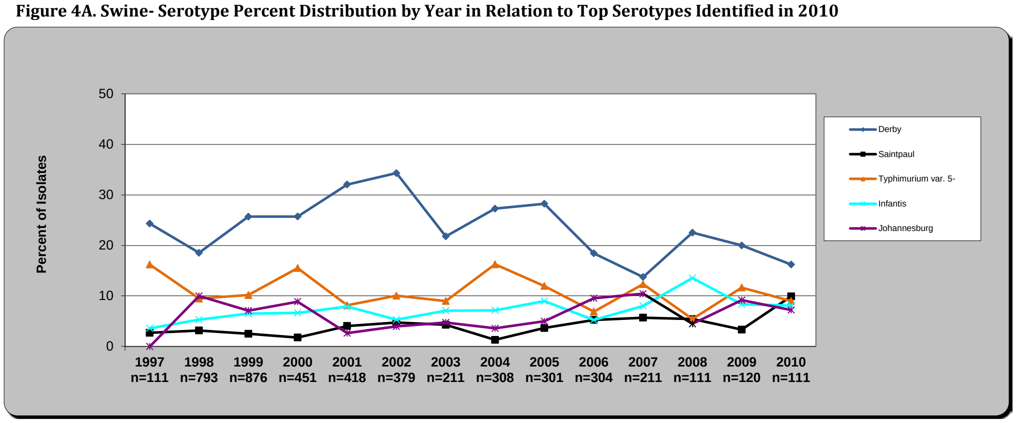


Table 3A. Distribution of MICs and Occurrence of Resistance by Animal Source among *Salmonella* , 2010

Antimicrobial	Isolate Source (# of Isolates)	%I[1]	%R[2]	95% CI[3]	0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
					Distribution (%) of MICs (µg/ml)[4]																
Aminoglycosides																					
Amikacin	Chickens (564)	0.0	**0.0**	0.0-0.8						13.1	74.1	12.2	0.5								
	Turkeys (151)	0.0	**0.0**	0.0-3.1						8.0	80.7	10.7	0.7								
	Cattle (247)	0.0	**0.0**	0.0-1.9						4.5	56.3	36.0	3.2								
	Swine (111)	0.0	**0.0**	0.0-4.2						3.6	72.1	21.6	1.8	0.9							
Gentamicin	Chickens (564)	0.5	**4.6**	3.1-6.8					79.6	14.7	0.2		0.4	0.5	**3.0**	**1.6**					
	Turkeys (151)	2.6	**19.9**	14.0-27.3					59.6	17.9				2.6	**7.9**	**11.9**					
	Cattle (247)	0.4	**4.9**	2.7-8.6					50.2	39.7	4.0		0.8	0.4	**2.8**	**2.0**					
	Swine (111)	2.7	**2.7**	0.7-8.3					64.9	27.0	2.7			2.7	**2.7**						
Kanamycin	Chickens (564)	0.2	**4.3**	2.8-6.4										95.6		0.2	**1.2**	**3.0**			
	Turkeys (151)	0.7	**19.2**	13.4-26.6										80.1		0.7	**2.0**	**17.2**			
	Cattle (247)	0.0	**12.6**	8.9-17.5										87.4			**0.8**	**11.7**			
	Swine (111)	0.0	**10.8**	5.9-18.5										88.3	0.9			**10.8**			
Streptomycin	Chickens (564)	N/A	**36.0**	32.1-40.1												64.0	**28.5**	**7.4**			
	Turkeys (151)	N/A	**27.8**	21.0-35.8												72.2	**17.2**	**10.6**			
	Cattle (247)	N/A	**26.7**	21.4-32.8												73.3	**4.9**	**21.9**			
	Swine (111)	N/A	**31.5**	23.2-41.1												68.5	**13.5**	**18.0**			
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Chickens (564)	0.7	**11.7**	9.2-14.7							83.7	3.0	0.5	0.4	0.7	**2.1**	**9.6**				
	Turkeys (151)	11.3	**15.2**	10.1-22.2							55.0	0.7	1.3	16.6	11.3	**1.3**	**13.9**				
	Cattle (247)	2.8	**21.5**	16.7-27.3							70.0	2.8	1.6	1.2	2.8	**2.8**	**18.6**				
	Swine (111)	4.5	**3.6**	1.2-9.5							82.0	1.8	4.5	3.6	4.5	**2.7**	**0.9**				
Cephems																					
Cefoxitin	Chickens (564)	0.4	**11.3**	8.9-14.3							7.3	66.0	14.2	0.9	0.4	**8.3**	**3.0**				
	Turkeys (151)	1.3	**15.2**	10.1-22.2							3.3	57.0	23.2		1.3	**6.6**	**8.6**				
	Cattle (247)	2.0	**20.6**	15.8-26.3							4.5	38.1	32.0	2.8	2.0	**5.3**	**15.4**				
	Swine (111)	0.0	**1.8**	0.3-7.0							3.6	43.2	46.8	4.5			**1.8**				
Ceftiofur	Chickens (564)	0.5	**12.1**	9.6-15.1				0.2	0.4	40.1	46.1	0.7	0.5	**1.8**	**10.3**						
	Turkeys (151)	0.0	**15.2**	10.1-22.2						23.8	60.9				**15.2**						
	Cattle (247)	0.4	**21.5**	16.7-27.3					1.6	28.3	47.4	0.8	0.4	**1.6**	**19.8**						
	Swine (111)	0.0	**1.8**	0.3-7.0						26.1	68.5	3.6			**1.8**						
Ceftriaxone	Chickens (564)	0.5	**11.9**	9.4-14.9					86.9	0.5	0.2	0.5	**0.2**	**1.8**	**6.9**	**1.4**	**1.4**	**0.2**			
	Turkeys (151)	0.7	**15.2**	10.1-22.2					84.1			0.7		**1.3**	**9.9**	**2.6**	**1.3**				
	Cattle (247)	0.0	**21.5**	16.7-27.3					77.7		0.8		**0.4**	**1.6**	**9.7**	**8.1**	**1.6**				
	Swine (111)	0.0	**1.8**	0.3-7.0					96.4	1.8					**0.9**		**0.9**				

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity 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 area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 3A (continued). Distribution of MICs and Occurrence of Resistance by Animal Source among *Salmonella* , 2010

Antimicrobial	Isolate Source (# of Isolates)	%I[1]	%R[2]	[95% CI][3]	Distribution (%) of MICs (µg/ml)[4] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Folate Pathway Inhibitors																					
Sulfisoxazole	Chickens (564)	N/A	**12.4**	9.9-15.5											8.9	30.0	46.8	1.4	0.5	**12.4**	
	Turkeys (151)	N/A	**25.2**	18.7-33.0											6.0	31.8	35.8		1.3	**25.2**	
	Cattle (247)	N/A	**26.3**	21.0-32.3											4.5	25.9	40.9	2.0	0.4	**26.3**	
	Swine (111)	N/A	**28.8**	20.8-38.3											18.9	21.6	27.0	2.7	0.9	**28.8**	
Trimethoprim-Sulfamethoxazole	Chickens (564)	N/A	**0.0**	0.0-0.8				99.6	0.4												
	Turkeys (151)	N/A	**0.0**	0.0-3.1				96.0	4.0												
	Cattle (247)	N/A	**4.5**	2.4-8.1				79.4	11.3	4.0		0.8	**0.8**	**3.6**							
	Swine (111)	N/A	**1.8**	0.3-7.0				91.0	6.3		0.9			**1.8**							
Penicillins																					
Ampicillin	Chickens (564)	0.2	**13.7**	11.0-16.9							82.8	3.2		0.2	0.2		**13.7**				
	Turkeys (151)	0.0	**44.4**	36.4-52.7							54.3	1.3				**1.3**	**43.0**				
	Cattle (247)	0.4	**26.3**	21.0-32.3							70.4	2.4	0.4		0.4	**0.4**	**25.9**				
	Swine (111)	0.0	**17.1**	10.9-25.7							81.1	1.8				**0.9**	**16.2**				
Phenicols																					
Chloramphenicol	Chickens (564)	0.4	**3.0**	1.8-4.9								4.6	62.4	29.6	0.4	**0.4**	**2.7**				
	Turkeys (151)	0.7	**4.6**	2.0-9.6								2.0	51.0	41.7	0.7		**4.6**				
	Cattle (247)	0.0	**25.1**	19.9-31.1								0.4	29.1	45.3		**0.4**	**24.7**				
	Swine (111)	0.0	**8.1**	4.0-15.2									29.7	62.2			**8.1**				
Quinolones																					
Ciprofloxacin	Chickens (564)	0.0	**0.0**	0.0-0.8	84.0	16.0															
	Turkeys (151)	0.0	**0.0**	0.0-3.1	96.7	1.3	1.3		0.7												
	Cattle (247)	0.0	**0.0**	0.0-1.9	87.0	10.1			2.4	0.4											
	Swine (111)	0.0	**0.0**	0.0-4.2	95.5	2.7	1.8														
Nalidixic Acid	Chickens (564)	N/A	**0.0**	0.0-0.8						0.2	0.2	53.4	45.7	0.5							
	Turkeys (151)	N/A	**0.7**	0-4.2								55.0	43.7	0.7			**0.7**				
	Cattle (247)	N/A	**2.8**	1.2-6.0								52.2	44.9				**2.8**				
	Swine (111)	N/A	**0.0**	0.0-4.2								46.8	51.4	1.8							
Tetracyclines																					
Tetracycline	Chickens (564)	0.9	**41.8**	37.7-46.0									57.3	0.9	**0.7**	**1.8**	**39.4**				
	Turkeys (151)	0.0	**57.6**	49.3-65.5									42.4			**3.3**	**54.3**				
	Cattle (247)	0.8	**33.6**	27.8-39.9									65.6	0.8		**5.3**	**28.3**				
	Swine (111)	0.9	**51.4**	41.8-60.9									47.7	0.9		**6.3**	**45.0**				

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction 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 area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 4A. Antimicrobial Resistance among *Salmonella* by Animal Source, 1997-2010

Year			1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested		Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	546
		Turkeys	107	240	713	518	550	244	262	236	227	304	271	148	121	151
		Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443	200	247
		Swine	111	793	876	451	418	379	211	308	301	304	211	111	120	111
Antimicrobial Class	**Antimicrobial**	**Isolate Source**														
Aminoglycosides	Amikacin	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	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	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	0	0	0	0	0	0
		Swine	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%
			0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Gentamicin	Chickens	17.8%	15.3%	10.4%	14.9%	7.9%	5.5%	6.3%	4.9%	4.3%	5.7%	4.5%	5.6%	5.6%	4.6%
			38	86	150	175	103	83	73	63	85	79	45	35	31	26
		Turkeys	20.6%	18.3%	17.5%	16.2%	20.9%	19.3%	21.0%	25.4%	22.9%	16.4%	12.9%	16.9%	14.9%	19.9%
			22	44	125	84	115	47	55	60	52	50	35	25	18	30
		Cattle	0.0%	1.8%	1.6%	2.1%	2.1%	2.6%	2.7%	1.8%	2.4%	3.9%	1.6%	1.6%	2.0%	4.9%
			0	5	25	29	19	26	18	11	8	15	7	7	4	12
		Swine	0.9%	0.8%	1.1%	1.3%	1.4%	0.8%	0.5%	1.3%	2.7%	2.0%	0.9%	2.7%	0.0%	2.7%
			1	6	10	6	6	3	1	4	8	6	2	3	0	3
	Kanamycin	Chickens	2.3%	3.2%	1.2%	4.1%	2.4%	2.0%	2.8%	2.7%	2.5%	3.6%	3.4%	3.4%	3.1%	4.3%
			5	18	17	48	31	30	32	34	49	49	34	21	17	24
		Turkeys	24.3%	17.1%	21.5%	21.4%	22.9%	24.2%	16.0%	14.4%	19.8%	10.5%	16.2%	14.2%	10.7%	19.2%
			26	41	153	111	126	59	42	34	45	32	44	21	13	29
		Cattle	8.3%	9.5%	7.1%	6.6%	6.9%	10.1%	13.7%	8.9%	13.1%	9.5%	7.7%	9.9%	9.0%	12.6%
			2	27	115	92	62	102	92	54	43	37	34	44	18	31
		Swine	11.7%	7.2%	6.7%	9.3%	6.9%	4.2%	5.7%	3.9%	5.0%	8.6%	7.1%	3.6%	4.2%	10.8%
			13	57	59	42	29	16	12	12	15	26	15	4	5	12
	Streptomycin	Chickens	24.3%	27.8%	27.5%	28.6%	21.0%	22.9%	19.6%	22.2%	23.3%	21.2%	19.3%	25.2%	30.5%	36.0%
			52	156	396	335	275	343	227	284	464	293	192	157	168	203
		Turkeys	34.6%	40.8%	43.6%	41.9%	46.7%	37.7%	29.4%	33.9%	40.1%	28.9%	34.7%	32.4%	38.8%	27.8%
			37	98	311	217	257	92	77	80	91	88	94	48	47	42
		Cattle	12.5%	16.2%	15.4%	21.3%	20.3%	25.9%	28.7%	20.9%	24.3%	23.7%	19.8%	23.0%	22.0%	26.7%
			3	46	248	296	181	261	192	127	80	92	87	102	44	66
		Swine	27.9%	29.4%	29.3%	39.2%	35.6%	40.1%	30.8%	36.4%	36.5%	26.3%	27.0%	29.7%	29.2%	31.5%
			31	233	257	177	149	152	65	112	110	80	57	33	35	35
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid	Chickens	0.5%	2.0%	4.9%	7.3%	4.5%	10.2%	9.7%	12.4%	12.1%	12.9%	15.6%	8.7%	12.9%	11.7%
			1	11	70	86	59	153	112	159	241	178	155	54	71	66
		Turkeys	4.7%	0.4%	4.3%	3.5%	6.9%	3.7%	1.5%	4.7%	3.5%	5.6%	11.1%	5.4%	13.2%	15.2%
			5	1	31	18	38	9	4	11	8	17	30	8	16	23
		Cattle	8.3%	2.5%	3.9%	9.9%	11.8%	17.7%	21.0%	13.5%	21.0%	18.5%	15.5%	16.5%	15.0%	21.5%
			2	7	62	138	105	178	141	82	69	72	68	73	30	53
		Swine	0.0%	0.4%	1.0%	1.8%	2.6%	3.7%	3.8%	1.9%	4.3%	2.3%	3.3%	4.5%	4.2%	3.6%
			0	3	9	8	11	14	8	6	13	7	7	5	5	4

Table 4A (continued). Resistance among *Salmonella* by Animal Source, 1997-2010

Year			1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested		Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	546
		Turkeys	107	240	713	518	550	244	262	236	227	304	271	148	121	151
		Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443	200	247
		Swine	111	793	876	451	418	379	211	308	301	304	211	111	120	111
Antimicrobial Class	**Antimicrobial**	**Isolate Source**														
Cephems	Cefoxitin	Chickens	Not Tested	Not Tested	Not Tested	7.2%	4.1%	8.7%	8.2%	12.4%	12.0%	12.8%	13.0%	8.0%	11.4%	11.3%
						85	53	130	95	159	238	176	129	50	63	64
		Turkeys	Not Tested	Not Tested	Not Tested	3.3%	4.5%	2.5%	1.1%	5.1%	3.5%	5.3%	9.2%	5.4%	12.4%	15.2%
						17	25	6	3	12	8	16	25	8	15	23
		Cattle	Not Tested	Not Tested	Not Tested	9.1%	11.1%	15.9%	17.8%	13.2%	19.8%	17.7%	15.0%	14.7%	13.5%	20.6%
						126	99	160	119	80	65	69	66	65	27	51
		Swine	Not Tested	Not Tested	Not Tested	1.3%	2.2%	2.9%	4.3%	1.9%	3.7%	2.0%	2.8%	4.5%	4.2%	1.8%
						6	9	11	9	6	11	6	6	5	5	2
	Ceftiofur	Chickens	0.5%	2.0%	5.2%	7.6%	4.1%	10.2%	9.8%	12.4%	12.2%	12.8%	15.4%	8.7%	12.7%	12.1%
			1	11	75	89	54	153	113	159	242	177	153	54	70	68
		Turkeys	3.7%	0.4%	4.6%	3.3%	5.1%	3.3%	1.5%	4.7%	3.5%	5.3%	11.1%	5.4%	12.4%	15.2%
			4	1	33	17	28	8	4	11	8	16	30	8	15	23
		Cattle	0.0%	2.1%	4.2%	9.8%	11.4%	17.4%	21.0%	13.3%	21.6%	18.8%	15.5%	16.3%	14.5%	21.5%
			0	6	67	136	102	175	141	81	71	73	68	72	29	53
		Swine	0.0%	0.1%	1.9%	1.3%	2.2%	3.2%	4.3%	1.9%	3.7%	2.0%	2.8%	4.5%	4.2%	1.8%
			0	1	17	6	9	12	9	6	11	6	6	5	5	2
	Ceftriaxone	Chickens	0.5%	1.8%	4.6%	7.4%	4.1%	9.9%	9.7%	12.3%	12.2%	12.8%	15.6%	8.7%	12.9%	11.9%
			1	10	66	87	54	149	112	158	242	177	155	54	71	67
		Turkeys	3.7%	0.4%	4.2%	3.1%	4.7%	3.3%	1.1%	4.7%	3.5%	5.3%	11.1%	5.4%	12.4%	15.2%
			4	1	30	16	26	8	3	11	8	16	30	8	15	23
		Cattle	0.0%	2.1%	3.9%	9.9%	11.3%	17.3%	21.0%	13.5%	20.7%	18.5%	15.9%	16.0%	14.5%	21.5%
			0	6	63	137	101	174	141	82	68	72	70	71	29	53
		Swine	0.0%	0.1%	1.3%	1.3%	2.2%	2.9%	4.3%	1.6%	3.7%	1.6%	2.4%	4.5%	4.2%	1.8%
			0	1	11	6	9	11	9	5	11	5	5	5	5	2
	Cephalothin	Chickens	1.4%	4.5%	5.8%	7.8%	4.7%	10.5%	10.4%	10.4%	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
			3	25	83	91	62	158	121	121						
		Turkeys	5.6%	5.0%	10.5%	8.3%	13.1%	9.8%	11.1%	11.1%	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
			6	12	75	43	72	24	29	29						
		Cattle	0.0%	2.1%	4.7%	9.9%	11.6%	17.7%	21.2%	21.2%	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
			0	6	76	137	104	178	142	142						
		Swine	0.0%	0.1%	0.8%	2.4%	2.2%	3.2%	3.8%	3.8%	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
			0	1	7	11	9	12	8	8						
Folate Pathway Inhibitors	Sulfonamides[1]	Chickens	24.8%	23.7%	15.9%	18.4%	11.8%	8.9%	10.3%	11.9%	8.5%	10.7%	10.4%	13.3%	10.0%	12.4%
			53	133	229	216	154	133	119	152	169	148	103	83	55	70
		Turkeys	37.4%	32.1%	36.0%	25.1%	38.0%	30.3%	28.2%	36.4%	37.0%	27.3%	25.5%	24.3%	28.9%	25.2%
			40	77	257	130	209	74	74	86	84	83	69	36	35	38
		Cattle	20.8%	15.5%	15.0%	19.9%	19.7%	22.3%	25.1%	22.7%	27.4%	24.2%	21.6%	24.8%	24.5%	26.3%
			5	44	242	276	176	225	168	138	90	94	95	110	49	65
		Swine	34.2%	29.0%	30.7%	35.7%	34.9%	34.6%	25.1%	37.0%	32.9%	26.6%	30.8%	31.5%	30.8%	28.8%
			38	230	269	161	146	131	53	114	99	81	65	35	37	32
	Trimethoprim-Sulfamethoxazole	Chickens	0.5%	1.2%	1.1%	0.4%	0.5%	0.8%	0.3%	0.2%	0.2%	0.1%	0.0%	0.3%	0.2%	0.0%
			1	7	16	5	6	12	4	3	4	1	0	2	1	0
		Turkeys	3.7%	2.5%	4.2%	1.5%	2.5%	2.5%	2.3%	0.8%	1.8%	1.0%	1.1%	1.4%	1.7%	0.0%
			4	6	30	8	14	6	6	2	4	3	3	2	2	0
		Cattle	4.2%	2.5%	2.4%	2.2%	2.6%	2.5%	3.3%	1.5%	4.9%	4.6%	3.0%	4.5%	1.5%	4.5%
			1	7	39	30	23	25	22	9	16	18	13	20	3	11
		Swine	1.8%	0.3%	1.1%	0.9%	0.0%	1.6%	2.4%	1.6%	2.3%	2.0%	1.9%	2.7%	2.5%	1.8%
			2	2	10	4	0	6	5	5	7	6	4	3	3	2

[1] Sulfamethoxazole was tested from 1997-2003 and was replaced by sulfisoxazole in 2004

Table 4A (continued). Resistance among *Salmonella* by Animal Source, 1997-2010

Year			1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested		Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	546
		Turkeys	107	240	713	518	550	244	262	236	227	304	271	148	121	151
		Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443	200	247
		Swine	111	793	876	451	418	379	211	308	301	304	211	111	120	111
Penicillins	Ampicillin	Chickens	11.7%	12.8%	12.4%	13.0%	9.4%	14.3%	13.7%	14.5%	14.0%	14.9%	17.0%	10.6%	13.8%	13.7%
			25	72	179	152	123	215	159	185	279	205	169	66	76	77
		Turkeys	12.1%	10.4%	17.7%	16.2%	19.5%	18.0%	18.7%	22.0%	22.9%	25.3%	36.9%	32.4%	38.8%	44.4%
			13	25	126	84	107	44	49	52	52	77	100	48	47	67
		Cattle	12.5%	9.2%	12.5%	18.7%	17.9%	23.9%	28.1%	19.3%	26.7%	22.4%	20.0%	21.7%	22.5%	26.3%
			3	26	202	259	160	241	188	117	88	87	88	96	45	65
		Swine	16.2%	12.9%	10.8%	18.8%	11.7%	13.7%	12.8%	16.2%	13.6%	11.5%	18.0%	14.4%	19.2%	17.1%
			18	102	95	85	49	52	27	50	41	35	38	16	23	19
Phenicols	Chloramphenicol	Chickens	2.3%	2.9%	1.8%	4.6%	2.5%	2.4%	2.1%	1.3%	1.8%	1.7%	1.8%	1.8%	1.6%	3.0%
			5	16	26	54	33	36	24	16	36	24	18	11	9	17
		Turkeys	3.7%	0.8%	4.1%	4.1%	3.8%	5.3%	4.2%	4.7%	4.8%	3.9%	5.5%	2.7%	3.3%	4.6%
			4	2	29	21	21	13	11	11	11	12	15	4	4	7
		Cattle	4.2%	5.6%	8.5%	15.1%	16.5%	20.6%	25.1%	17.6%	21.9%	19.8%	20.0%	19.6%	21.0%	25.1%
			1	16	137	209	147	208	168	107	72	77	88	87	42	62
		Swine	11.7%	8.4%	8.0%	12.4%	7.7%	10.0%	8.5%	12.7%	10.6%	7.9%	15.2%	9.9%	15.0%	8.1%
			13	67	70	56	32	38	18	39	32	24	32	11	18	9
Quinolones	Ciprofloxacin	Chickens	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
			0	0	0	0	0	0	1	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	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	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	0	0	0	0	0	0
	Nalidixic Acid	Chickens	0.0%	0.2%	0.2%	0.5%	0.0%	0.8%	0.4%	0.5%	0.3%	0.1%	0.1%	0.0%	0.0%	0.0%
			0	1	3	6	0	12	5	6	6	2	1	0	0	0
		Turkeys	4.7%	2.1%	5.3%	5.4%	5.1%	5.3%	3.8%	2.1%	2.2%	0.7%	1.1%	0.7%	0.8%	0.7%
			5	5	38	28	28	13	10	5	5	2	3	1	1	1
		Cattle	0.0%	0.4%	0.1%	0.4%	0.4%	0.4%	0.4%	2.0%	1.5%	0.5%	0.7%	0.7%	1.0%	2.8%
			0	1	1	6	4	4	3	12	5	2	3	3	2	7
		Swine	0.0%	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%
			0	0	0	1	0	1	0	0	1	0	0	0	0	0
Tetracyclines	Tetracycline	Chickens	20.6%	20.5%	25.0%	26.3%	21.9%	24.9%	26.2%	27.4%	28.3%	31.8%	35.5%	30.4%	33.9%	41.8%
			44	115	359	308	286	374	303	351	563	439	353	190	187	236
		Turkeys	52.3%	45.8%	52.9%	56.2%	54.9%	54.5%	58.8%	48.3%	54.6%	61.8%	73.8%	64.2%	63.6%	57.6%
			56	110	377	291	302	133	154	114	124	188	200	95	77	87
		Cattle	25.0%	24.3%	20.9%	25.8%	26.3%	32.0%	36.9%	31.8%	34.0%	30.3%	27.3%	29.3%	29.0%	33.6%
			6	69	336	358	235	323	247	193	112	118	120	130	58	83
		Swine	52.3%	47.5%	48.4%	54.3%	53.1%	57.8%	43.1%	58.8%	54.8%	62.8%	54.5%	51.4%	53.3%	51.4%
			58	377	424	245	222	219	91	181	165	191	115	57	64	57

Table 5A. Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Chickens, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[2]	%R[3]	95% CI[4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Aminoglycosides																					
Amikacin	Kentucky (243)	0.0	**0.0**	0.0-1.9						8.2	78.6	12.8	0.4								
	Enteritidis (152)	0.0	**0.0**	0.0-3.1						19.1	73.7	7.2									
	Typhimurium var. 5- (29)	0.0	**0.0**	0.0-14.6						41.4	51.7	6.9									
	Typhimurium (25)	0.0	**0.0**	0.0-16.6						8.0	76.0	12.0	4.0								
	Heidelberg (25)	0.0	**0.0**	0.0-16.6						28.0	60.0	12.0									
	I 4,5,12:i:- (11)	0.0	**0.0**	0.0-32.1						9.1	81.8		9.1								
Gentamicin	Kentucky (243)	0.0	**1.6**	0.5-4.4					79.0	19.3					**0.8**	**0.8**					
	Enteritidis (152)	0.0	**0.7**	0-4.2					94.7	3.9			0.7		**0.7**						
	Typhimurium var. 5- (29)	0.0	**6.9**	1.2-24.2					86.2	6.9					**6.9**						
	Typhimurium (25)	4.0	**28.0**	12.9-49.6					64.0	4.0				4.0	**24.0**	**4.0**					
	Heidelberg (25)	4.0	**4.0**	0.2-22.3					76.0	12.0			4.0	4.0		**4.0**					
	I 4,5,12:i:- (11)	0.0	**27.3**	7.3-60.7					27.3	45.5					**27.3**						
Kanamycin	Kentucky (243)	0.0	**0.0**	0.0-1.9										100.0							
	Enteritidis (152)	0.0	**0.7**	0-4.2										99.3				**0.7**			
	Typhimurium var. 5- (29)	0.0	**10.3**	2.7-28.4										89.7				**10.3**			
	Typhimurium (25)	0.0	**32.0**	15.7-53.6										68.0			**20.0**	**12.0**			
	Heidelberg (25)	0.0	**24.0**	10.2-45.5										76.0			**4.0**	**20.0**			
	I 4,5,12:i:- (11)	0.0	**18.2**	3.2-52.3										81.8				**18.2**			
Streptomycin	Kentucky (243)	0.0	**67.9**	61.6-73.6												32.1	**58.4**	**9.5**			
	Enteritidis (152)	0.0	**1.3**	0.2-5.1												98.7	**0.7**	**0.7**			
	Typhimurium var. 5- (29)	0.0	**17.2**	6.5-36.4												82.8	**10.3**	**6.9**			
	Typhimurium (25)	0.0	**44.0**	25.0-64.7												56.0	**20.0**	**24.0**			
	Heidelberg (25)	0.0	**12.0**	3.2-32.3												88.0		**12.0**			
	I 4,5,12:i:- (11)	0.0	**9.1**	0.5-42.9												90.9		**9.1**			

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints were established by NARMS.

Table 5A (continued). Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Chickens, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[2]	%R[3]	95% CI[4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Kentucky (243)	0.0	**15.2**	11.1-20.5							83.5	1.2				**1.6**	**13.6**				
	Enteritidis (152)	0.7	**0.0**	0.0-3.1							92.8	5.9	0.7		0.7						
	Typhimurium var. 5- (29)	3.4	**34.5**	18.6-54.4							55.2	3.4		3.4	3.4	**17.2**	**17.2**				
	Typhimurium (25)	4.0	**32.0**	15.7-53.6							60.0			4.0	4.0	**4.0**	**28.0**				
	Heidelberg (25)	0.0	**24.0**	10.2-45.5							64.0	8.0	4.0			**4.0**	**20.0**				
	I 4,5,12:i:- (11)	9.1	**0.0**	0.0-32.1							90.9				9.1						
Cephems																					
Cefoxitin	Kentucky (243)	0.4	**14.8**	10.7-20.0							12.8	60.9	11.1		0.4	**12.8**	**2.1**				
	Enteritidis (152)	0.0	**0.0**	0.0-3.1								87.5	11.2	1.3							
	Typhimurium var. 5- (29)	3.4	**31.0**	15.9-50.9							3.4	51.7	10.3		3.4	**24.1**	**6.9**				
	Typhimurium (25)	0.0	**32.0**	15.7-53.6							16.0	44.0	4.0	4.0		**12.0**	**20.0**				
	Heidelberg (25)	0.0	**24.0**	10.2-45.5							8.0	52.0	16.0			**12.0**	**12.0**				
	I 4,5,12:i:- (11)	0.0	**0.0**	0.0-32.1							9.1	72.7	18.2								
Ceftiofur	Kentucky (243)	0.4	**15.2**	11.1-20.5				0.4	0.4	68.7	14.8		0.4	**0.8**	**14.4**						
	Enteritidis (152)	0.0	**1.3**	0.2-5.1						1.3	96.1	1.3		**1.3**							
	Typhimurium var. 5- (29)	0.0	**34.5**	18.6-54.4					3.4	44.8	17.2			**13.8**	**20.7**						
	Typhimurium (25)	4.0	**32.0**	15.7-53.6						36.0	28.0		4.0		**32.0**						
	Heidelberg (25)	0.0	**24.0**	10.2-45.5						24.0	52.0			**8.0**	**16.0**						
	I 4,5,12:i:- (11)	0.0	**0.0**	0.0-32.1						27.3	72.7										
Ceftriaxone	Kentucky (243)	0.0	**15.2**	11.1-20.5					84.0	0.4	0.4		**0.4**	**0.8**	**11.1**	**1.6**	**1.2**				
	Enteritidis (152)	0.0	**0.7**	0-4.2					98.7	0.7				**0.7**							
	Typhimurium var. 5- (29)	0.0	**34.5**	18.6-54.4					65.5					**17.2**	**10.3**	**3.4**	**3.4**				
	Typhimurium (25)	4.0	**32.0**	15.7-53.6					64.0			4.0			**8.0**	**8.0**	**12.0**	**4.0**			
	Heidelberg (25)	4.0	**24.0**	10.2-45.5					72.0			4.0		**8.0**	**12.0**		**4.0**				
	I 4,5,12:i:- (11)	0.0	**0.0**	0.0-32.1					100.0												

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 5A (continued). Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Chickens, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[2]	%R[3]	95% CI[4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Folate Pathway Inhibitors																					
Sulfisoxazole	Kentucky (243)	N/A	**1.6**	0.5-4.4											12.3	40.3	44.4	1.2		**1.6**	
	Enteritidis (152)	N/A	**2.0**	0.5-6.1											1.3	12.5	79.6	2.6	2.0	**2.0**	
	Typhimurium var. 5- (29)	N/A	**93.1**	75.8-98.8												6.9				**93.1**	
	Typhimurium (25)	N/A	**36.0**	18.7-57.4											16.0	40.0	8.0			**36.0**	
	Heidelberg (25)	N/A	**52.0**	31.8-71.7											12.0	24.0	12.0			**52.0**	
	I 4,5,12:i:- (11)	N/A	**36.4**	12.4-68.4												36.4	27.3			**36.4**	
Trimethoprim-Sulfamethoxazole	Kentucky (243)	N/A	**0.0**	0.0-1.9				100.0													
	Enteritidis (152)	N/A	**0.0**	0.0-3.1				100.0													
	Typhimurium var. 5- (29)	N/A	**0.0**	0.0-14.6				100.0													
	Typhimurium (25)	N/A	**0.0**	0.0-16.6				100.0													
	Heidelberg (25)	N/A	**0.0**	0.0-16.6				100.0													
	I 4,5,12:i:- (11)	N/A	**0.0**	0.0-32.1				100.0													
Penicillins																					
Ampicillin	Kentucky (243)	0.0	**15.2**	11.1-20.5							83.1	1.6					**15.2**				
	Enteritidis (152)	0.0	**2.6**	0.8-7.0							91.4	5.3		0.7			**2.6**				
	Typhimurium var. 5- (29)	0.0	**41.4**	24.1-60.9							55.2	3.4					**41.4**				
	Typhimurium (25)	4.0	**40.0**	21.8-61.1							56.0				4.0		**40.0**				
	Heidelberg (25)	0.0	**28.0**	12.9-49.6							72.0						**28.0**				
	I 4,5,12:i:- (11)	0.0	**9.1**	0.5-42.9							90.9						**9.1**				

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 5A (continued). Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Chickens, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[2]	%R[3]	95% CI[4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Phenicols																					
Chloramphenicol	Kentucky (243)	0.0	**1.2**	0.3-3.8								10.7	83.5	4.5			**1.2**				
	Enteritidis (152)	0.0	**1.3**	0.2-5.1									48.0	50.7		**0.7**	**0.7**				
	Typhimurium var. 5- (29)	0.0	**3.4**	0.2-19.6									69.0	27.6			**3.4**				
	Typhimurium (25)	0.0	**20.0**	7.6-41.3									20.0	60.0		**4.0**	**16.0**				
	Heidelberg (25)	0.0	**4.0**	0.2-22.3									64.0	32.0			**4.0**				
	I 4,5,12:i:- (11)	0.0	**0.0**	0.0-32.1									72.7	27.3							
Quinolones																					
Ciprofloxacin	Kentucky (243)	0.0	**0.0**	0.0-1.9	99.2	0.8															
	Enteritidis (152)	0.0	**0.0**	0.0-3.1	48.7	51.3															
	Typhimurium var. 5- (29)	0.0	**0.0**	0.0-14.6	100.0																
	Typhimurium (25)	0.0	**0.0**	0.0-16.6	92.0	8.0															
	Heidelberg (25)	0.0	**0.0**	0.0-16.6	100.0																
	I 4,5,12:i:- (11)	0.0	**0.0**	0.0-32.1	100.0																
Nalidixic Acid	Kentucky (243)	N/A	**0.0**	0.0-1.9						0.4	0.4	88.5	10.7								
	Enteritidis (152)	N/A	**0.0**	0.0-3.1								13.8	85.5	0.7							
	Typhimurium var. 5- (29)	N/A	**0.0**	0.0-14.6								34.5	65.5								
	Typhimurium (25)	N/A	**0.0**	0.0-16.6								4.0	92.0	4.0							
	Heidelberg (25)	N/A	**0.0**	0.0-16.6								52.0	48.0								
	I 4,5,12:i:- (11)	N/A	**0.0**	0.0-32.1								63.6	36.4								
Tetracyclines																					
Tetracycline	Kentucky (243)	1.2	**69.5**	63.2-75.1									29.2	1.2	**0.4**	**0.8**	**68.3**				
	Enteritidis (152)	0.7	**3.3**	1.2-7.9									96.1	0.7	**0.7**	**2.6**					
	Typhimurium var. 5- (29)	0.0	**86.2**	67.4-95.5									13.8			**3.4**	**82.8**				
	Typhimurium (25)	0.0	**32.0**	15.7-53.6									68.0		**4.0**		**28.0**				
	Heidelberg (25)	0.0	**56.0**	35.3-75.0									44.0				**56.0**				
	I 4,5,12:i:- (11)	0.0	**18.2**	3.2-52.3									81.8			**9.1**	**9.1**				

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 6A. Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Turkeys, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[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	512	1024
					Distribution (%) of MICs (µg/ml)[5]																
Aminoglycosides																					
Amikacin	Hadar (30)	0.0	**0.0**	0.0-14.1							86.7	13.3									
	Saintpaul (21)	0.0	**0.0**	0.0-19.2						4.8	81.0	14.3									
	Heidelberg (14)	0.0	**0.0**	0.0-26.8						7.1	85.7	7.1									
	Schwarzengrund (11)	0.0	**0.0**	0.0-32.1						9.1	90.9										
	III 18:z4,z23:- (11)	0.0	**0.0**	0.0-32.1						36.4	63.6										
	Muenchen (10)	0.0	**0.0**	0.0-34.5							90.0	10.0									
Gentamicin	Hadar (30)	0.0	**10.0**	2.6-27.7					63.3	26.7						**10.0**					
	Saintpaul (21)	0.0	**14.3**	3.8-37.4					81.0	4.8						**14.3**					
	Heidelberg (14)	7.1	**21.4**	5.7-51.2					64.3	7.1				7.1	**14.3**	**7.1**					
	Schwarzengrund (11)	9.1	**0.0**	0.0-32.1					63.6	27.3				9.1							
	III 18:z4,z23:- (11)	9.1	**18.2**	3.2-52.3					72.7					9.1	**18.2**						
	Muenchen (10)	0.0	**10.0**	0.5-45.9					80.0	10.0						**10.0**					
Kanamycin	Hadar (30)	0.0	**13.3**	4.3-31.6										86.7				**13.3**			
	Saintpaul (21)	0.0	**4.8**	0.3-25.9										95.2				**4.8**			
	Heidelberg (14)	0.0	**64.3**	35.6-86.0										35.7			**7.1**	**57.1**			
	Schwarzengrund (11)	0.0	**0.0**	0.0-32.1										100.0							
	III 18:z4,z23:- (11)	9.1	**45.5**	18.2-75.5										45.5		9.1		**45.5**			
	Muenchen (10)	0.0	**0.0**	0.0-34.5										100.0							
Streptomycin	Hadar (30)	N/A	**50.0**	31.7-68.3												50.0	**46.7**	**3.3**			
	Saintpaul (21)	N/A	**9.5**	1.7-31.8												90.5	**4.8**	**4.8**			
	Heidelberg (14)	N/A	**57.1**	29.6-81.2												42.9	**21.4**	**35.7**			
	Schwarzengrund (11)	N/A	**27.3**	7.3-60.7												72.7	**27.3**				
	III 18:z4,z23:- (11)	N/A	**9.1**	0.5-42.9												90.9	**9.1**				
	Muenchen (10)	N/A	**0.0**	0.0-34.5												100.0					
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Hadar (30)	26.7	**0.0**	0.0-14.1							60.0			13.3	26.7						
	Saintpaul (21)	0.0	**9.5**	1.7-31.8							38.1			52.4			**9.5**				
	Heidelberg (14)	0.0	**35.7**	14.0-64.4							42.9			21.4		**7.1**	**28.6**				
	Schwarzengrund (11)	9.1	**27.3**	7.3-60.7							54.5		9.1		9.1	**9.1**	**18.2**				
	III 18:z4,z23:- (11)	0.0	**0.0**	0.0-32.1							100.0										
	Muenchen (10)	10.0	**10.0**	0.5-45.9							70.0	10.0			10.0		**10.0**				
Cephems																					
Cefoxitin	Hadar (30)	3.3	**0.0**	0.0-14.1								86.7	10.0		3.3						
	Saintpaul (21)	0.0	**9.5**	1.7-31.8								76.2	14.3				**9.5**				
	Heidelberg (14)	0.0	**35.7**	14.0-64.4							21.4	42.9				**21.4**	**14.3**				
	Schwarzengrund (11)	0.0	**27.3**	7.3-60.7								54.5	18.2			**27.3**					
	III 18:z4,z23:- (11)	0.0	**0.0**	0.0-32.1							9.1	90.9									
	Muenchen (10)	0.0	**10.0**	0.5-45.9								80.0	10.0			**10.0**					
Ceftiofur	Hadar (30)	0.0	**0.0**	0.0-14.1						6.7	93.3										
	Saintpaul (21)	0.0	**9.5**	1.7-31.8						4.8	85.7				**9.5**						
	Heidelberg (14)	0.0	**35.7**	14.0-64.4						35.7	28.6				**35.7**						
	Schwarzengrund (11)	0.0	**27.3**	7.3-60.7						54.5	18.2				**27.3**						
	III 18:z4,z23:- (11)	0.0	**0.0**	0.0-32.1						90.9	9.1										
	Muenchen (10)	0.0	**10.0**	0.5-45.9						70.0	20.0				**10.0**						
Ceftriaxone	Hadar (30)	0.0	**0.0**	0.0-14.1					100.0												
	Saintpaul (21)	0.0	**9.5**	1.7-31.8					90.5						**9.5**						
	Heidelberg (14)	0.0	**35.7**	14.0-64.4					64.3					**7.1**	**21.4**	**7.1**					
	Schwarzengrund (11)	0.0	**0.0**	0.0-32.1					100.0												
	III 18:z4,z23:- (11)	9.1	**27.3**	7.3-60.7					63.6			9.1		**9.1**	**18.2**						
	Muenchen (10)	0.0	**10.0**	0.5-45.9					90.0						**10.0**						

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 6A (continued). Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Turkeys, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[2]	%R[3]	95% CI[4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Folate Pathway Inhibitors																					
Sulfonamides	Hadar (30)	N/A	**6.7**	1.2-23.6											3.3	36.7	53.3			**6.7**	
	Saintpaul (21)	N/A	**4.8**	0.3-25.9												14.3	81.0			**4.8**	
	Heidelberg (14)	N/A	**28.6**	9.6-58.0												42.9	28.6			**28.6**	
	Schwarzengrund (11)	N/A	**36.4**	12.4-68.4											9.1	54.5				**36.4**	
	III 18:z4,z23:- (11)	N/A	**27.3**	7.3-60.7												72.7				**27.3**	
	Muenchen (10)	N/A	**70.0**	35.4-91.9											10.0	10.0	10.0			**70.0**	
Trimethoprim-Sulfamethoxazole	Hadar (30)	N/A	**0.0**	0.0-14.1				100.0													
	Saintpaul (21)	N/A	**0.0**	0.0-19.2				100.0													
	Heidelberg (14)	N/A	**0.0**	0.0-26.8				100.0													
	Schwarzengrund (11)	N/A	**0.0**	0.0-32.1				100.0													
	III 18:z4,z23:- (11)	N/A	**0.0**	0.0-32.1				100.0													
	Muenchen (10)	N/A	**0.0**	0.0-34.5				100.0													
Penicillins																					
Ampicillin	Hadar (30)	0.0	**40.0**	23.2-59.3							60.0					**3.3**	**36.7**				
	Saintpaul (21)	0.0	**61.9**	38.7-81.0							28.6	9.5					**61.9**				
	Heidelberg (14)	0.0	**57.1**	29.6-81.2							42.9						**57.1**				
	Schwarzengrund (11)	0.0	**45.5**	18.2-75.5							54.5					**9.1**	**36.4**				
	III 18:z4,z23:- (11)	0.0	**0.0**	0.0-32.1							100.0										
	Muenchen (10)	0.0	**20.0**	3.5-55.8							80.0						**20.0**				
Phenicols																					
Chloramphenicol	Hadar (30)	0.0	**3.3**	0.2-19.0								10.0	83.3	3.3			**3.3**				
	Saintpaul (21)	0.0	**4.8**	0.3-25.9									19.0	76.2			**4.8**				
	Heidelberg (14)	0.0	**0.0**	0.0-26.8									14.3	85.7							
	Schwarzengrund (11)	0.0	**0.0**	0.0-32.1									72.7	27.3							
	III 18:z4,z23:- (11)	0.0	**0.0**	0.0-32.1									100.0								
	Muenchen (10)	0.0	**0.0**	0.0-34.5									100.0								
Quinolones																					
Ciprofloxacin	Hadar (30)	0.0	**0.0**	0.0-14.1	100.0																
	Saintpaul (21)	0.0	**0.0**	0.0-19.2	100.0																
	Heidelberg (14)	0.0	**0.0**	0.0-26.8	100.0																
	Schwarzengrund (11)	0.0	**0.0**	0.0-32.1	100.0																
	III 18:z4,z23:- (11)	0.0	**0.0**	0.0-32.1	100.0																
	Muenchen (10)	0.0	**0.0**	0.0-34.5	100.0																
Nalidixic Acid	Hadar (30)	0.0	**0.0**	0.0-14.1								50.0	50.0								
	Saintpaul (21)	0.0	**0.0**	0.0-19.2								85.7	14.3								
	Heidelberg (14)	0.0	**0.0**	0.0-26.8								7.1	92.9								
	Schwarzengrund (11)	0.0	**0.0**	0.0-32.1								72.7	27.3								
	III 18:z4,z23:- (11)	0.0	**0.0**	0.0-32.1								100.0									
	Muenchen (10)	0.0	**0.0**	0.0-34.5								80.0	20.0								
Tetracyclines																					
Tetracycline	Hadar (30)	0.0	**93.3**	76.4-98.8									6.7			**3.3**	**90.0**				
	Saintpaul (21)	0.0	**57.1**	34.4-77.4									42.9			**4.8**	**52.4**				
	Heidelberg (14)	0.0	**100.0**	73.2-100													**100.0**				
	Schwarzengrund (11)	0.0	**36.4**	12.4-68.4									63.6			**9.1**	**27.3**				
	III 18:z4,z23:- (11)	0.0	**18.2**	3.2-52.3									81.8				**18.2**				
	Muenchen (10)	0.0	**70.0**	35.4-91.9									30.0				**70.0**				

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 7A. Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Cattle, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[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	512	1024
					Distribution (%) of MICs (µg/ml)[5]																
Aminoglycosides																					
Amikacin	Montevideo (61)	0.0	**0.0**	0.0-7.4							57.4	41.0	1.6								
	Dublin (41)	0.0	**0.0**	0.0-10.7							29.3	65.9	4.9								
	Kentucky (13)	0.0	**0.0**	0.0-28.3							61.5	38.5									
	Anatum (12)	0.0	**0.0**	0.0-30.1						16.7	83.3										
	Typhimurium (11)	0.0	**0.0**	0.0-32.1							54.5	45.5									
	Cerro (10)	0.0	**0.0**	0.0-34.5							60.0	20.0	20.0								
Gentamicin	Montevideo (61)	0.0	**0.0**	0.0-7.4					49.2	47.5	3.3										
	Dublin (41)	0.0	**19.5**	9.4-35.4					14.6	53.7	9.8		2.4		**9.8**	**9.8**					
	Kentucky (13)	0.0	**0.0**	0.0-28.3					30.8	69.2											
	Anatum (12)	0.0	**0.0**	0.0-30.1					100.0												
	Typhimurium (11)	0.0	**0.0**	0.0-32.1					36.4	63.6											
	Cerro (10)	0.0	**0.0**	0.0-34.5					60.0	30.0	10.0										
Kanamycin	Montevideo (61)	0.0	**0.0**	0.0-7.4										100.0							
	Dublin (41)	0.0	**56.1**	39.9-71.2										43.9			**4.9**	**51.2**			
	Kentucky (13)	0.0	**0.0**	0.0-28.3										100.0							
	Anatum (12)	0.0	**0.0**	0.0-30.1										100.0							
	Typhimurium (11)	0.0	**9.1**	0.5-42.9										90.9				**9.1**			
	Cerro (10)	0.0	**0.0**	0.0-34.5										100.0							
Streptomycin	Montevideo (61)	N/A	**3.3**	0.6-12.4												96.7	**3.3**				
	Dublin (41)	N/A	**78.0**	61.9-88.9												22.0	**2.4**	**75.6**			
	Kentucky (13)	N/A	**23.1**	6.2-54.0												76.9	**15.4**	**7.7**			
	Anatum (12)	N/A	**0.0**	0.0-30.1												100.0					
	Typhimurium (11)	N/A	**45.5**	18.2-75.5												54.5	**27.3**	**18.2**			
	Cerro (10)	N/A	**0.0**	0.0-34.5												100.0					
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Montevideo (61)	0.0	**0.0**	0.0-7.4							96.7	3.3									
	Dublin (41)	2.4	**70.7**	54.2-83.3							12.2	7.3	4.9	2.4	2.4		**70.7**				
	Kentucky (13)	0.0	**0.0**	0.0-28.3							100.0										
	Anatum (12)	0.0	**0.0**	0.0-30.1							100.0										
	Typhimurium (11)	18.2	**18.2**	3.2-52.3							54.5			9.1	18.2		**18.2**				
	Cerro (10)	0.0	**0.0**	0.0-34.5							90.0		10.0								

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 7A (continued). Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Cattle, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[2]	%R[3]	95% CI[4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Cephems																					
Cefoxitin	Montevideo (61)	1.6	**0.0**	0.0-7.4							6.6	83.6	4.9	3.3	1.6						
	Dublin (41)	2.4	**68.3**	51.8-81.4							4.9	4.9	12.2	7.3	2.4	**2.4**	**65.9**				
	Kentucky (13)	0.0	**0.0**	0.0-28.3								38.5	61.5								
	Anatum (12)	0.0	**0.0**	0.0-30.1									100.0								
	Typhimurium (11)	0.0	**18.2**	3.2-52.3								72.7	9.1			**9.1**	**9.1**				
	Cerro (10)	10.0	**0.0**	0.0-34.5							20.0	40.0	30.0		10.0						
Ceftiofur	Montevideo (61)	0.0	**0.0**	0.0-7.4						57.4	42.6										
	Dublin (41)	0.0	**70.7**	54.2-83.3					7.3	12.2	9.8			**7.3**	**63.4**						
	Kentucky (13)	0.0	**0.0**	0.0-28.3						30.8	69.2										
	Anatum (12)	0.0	**0.0**	0.0-30.1							100.0										
	Typhimurium (11)	0.0	**18.2**	3.2-52.3						36.4	36.4	9.1			**18.2**						
	Cerro (10)	10.0	**0.0**	0.0-34.5						40.0	50.0		10.0								
Ceftriaxone	Montevideo (61)	0.0	**0.0**	0.0-7.4					100.0												
	Dublin (41)	0.0	**70.7**	54.2-83.3					26.8		2.4		**2.4**		**31.7**	**26.8**	**9.8**				
	Kentucky (13)	0.0	**0.0**	0.0-28.3					100.0												
	Anatum (12)	0.0	**0.0**	0.0-30.1					100.0												
	Typhimurium (11)	0.0	**18.2**	3.2-52.3					81.8						**18.2**						
	Cerro (10)	0.0	**0.0**	0.0-34.5					90.0		10.0										
Folate Pathway Inhibitors																					
Sulfonamides	Montevideo (61)	N/A	**0.0**	0.0-7.4											4.9	52.5	42.6				
	Dublin (41)	N/A	**90.2**	75.9-96.8											7.3	2.4				**90.2**	
	Kentucky (13)	N/A	**0.0**	0.0-28.3												15.4	84.6				
	Anatum (12)	N/A	**0.0**	0.0-30.1												16.7	83.3				
	Typhimurium (11)	N/A	**45.5**	18.2-75.5												36.4	18.2			**45.5**	
	Cerro (10)	N/A	**0.0**	0.0-34.5												10.0	70.0	10.0	10.0		
Trimethoprim-Sulfamethoxazole	Montevideo (61)	N/A	**0.0**	0.0-7.4				100.0													
	Dublin (41)	N/A	**2.4**	0.1-14.4				9.8	63.4	22.0		2.4	**2.4**								
	Kentucky (13)	N/A	**0.0**	0.0-28.3				100.0													
	Anatum (12)	N/A	**0.0**	0.0-30.1				100.0													
	Typhimurium (11)	N/A	**0.0**	0.0-32.1				90.9	9.1												
	Cerro (10)	N/A	**0.0**	0.0-34.5				100.0													

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 7A (continued). Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Cattle, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[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	512	1024
					Distribution (%) of MICs (µg/ml)[5]																
Penicillins																					
Ampicillin	Montevideo (61)	0.0	**0.0**	0.0-7.4							96.7	1.6	1.6								
	Dublin (41)	2.4	**78.0**	61.9-88.9							12.2	7.3			2.4		**78.0**				
	Kentucky (13)	0.0	**0.0**	0.0-28.3							100.0										
	Anatum (12)	0.0	**0.0**	0.0-30.1							100.0										
	Typhimurium (11)	0.0	**45.5**	18.2-75.5							54.5						**45.5**				
	Cerro (10)	0.0	**0.0**	0.0-34.5							100.0										
Phenicols																					
Chloramphenicol	Montevideo (61)	0.0	**0.0**	0.0-7.4									42.6	57.4							
	Dublin (41)	0.0	**92.7**	79.0-98.1									7.3			**2.4**	**90.2**				
	Kentucky (13)	0.0	**0.0**	0.0-28.3								7.7	46.2	46.2							
	Anatum (12)	0.0	**0.0**	0.0-30.1									16.7	83.3							
	Typhimurium (11)	0.0	**36.4**	12.4-68.4									36.4	27.3			**36.4**				
	Cerro (10)	0.0	**0.0**	0.0-34.5									70.0	30.0							
Quinolones																					
Ciprofloxacin	Montevideo (61)	0.0	**0.0**	0.0-7.4	100.0																
	Dublin (41)	0.0	**0.0**	0.0-10.7	36.6	48.8			12.2	2.4											
	Kentucky (13)	0.0	**0.0**	0.0-28.3	100.0																
	Anatum (12)	0.0	**0.0**	0.0-30.1	91.7	8.3															
	Typhimurium (11)	0.0	**0.0**	0.0-32.1	100.0																
	Cerro (10)	0.0	**0.0**	0.0-34.5	100.0																
Nalidixic Acid	Montevideo (61)	N/A	**0.0**	0.0-7.4								88.5	11.5								
	Dublin (41)	N/A	**14.6**	6.1-29.8								9.8	75.6				**14.6**				
	Kentucky (13)	N/A	**0.0**	0.0-28.3								46.2	53.8								
	Anatum (12)	N/A	**0.0**	0.0-30.1									100.0								
	Typhimurium (11)	N/A	**0.0**	0.0-32.1								18.2	81.8								
	Cerro (10)	N/A	**0.0**	0.0-34.5								80.0	20.0								
Tetracyclines																					
Tetracycline	Montevideo (61)	0.0	**11.5**	5.1-22.9									88.5			**4.9**	**6.6**				
	Dublin (41)	0.0	**85.4**	70.2-93.9									14.6				**85.4**				
	Kentucky (13)	0.0	**53.8**	26.1-79.6									46.2			**7.7**	**46.2**				
	Anatum (12)	0.0	**0.0**	0.0-30.1									100.0								
	Typhimurium (11)	0.0	**45.5**	18.2-75.5									54.5			**18.2**	**27.3**				
	Cerro (10)	0.0	**10.0**	0.5-45.9									90.0			**10.0**					

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 8A. Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Swine, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[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	512	1024
					Distribution (%) of MICs (µg/ml)[5]																
Aminoglycosides																					
Amikacin	Derby (18)	0.0	**0.0**	0.0-21.9							38.9	44.4	11.1	5.6							
	Saintpaul (11)	0.0	**0.0**	0.0-32.1							81.8	18.2									
	Typhimurium var. 5- (10)	0.0	**0.0**	0.0-34.5							90.0	10.0									
Gentamicin	Derby (18)	5.6	**0.0**	0.0-21.9					33.3	44.4	16.7			5.6							
	Saintpaul (11)	0.0	**0.0**	0.0-32.1					72.7	27.3											
	Typhimurium var. 5- (10)	0.0	**10.0**	0.5-45.9					80.0	10.0					**10.0**						
Kanamycin	Derby (18)	0.0	**0.0**	0.0-21.9										100.0							
	Saintpaul (11)	0.0	**0.0**	0.0-32.1										100.0							
	Typhimurium var. 5- (10)	0.0	**10.0**	0.5-45.9										90.0				**10.0**			
Streptomycin	Derby (18)	0.0	**50.0**	26.8-73.2												50.0	**5.6**	**44.4**			
	Saintpaul (11)	0.0	**0.0**	0.0-32.1												100.0					
	Typhimurium var. 5- (10)	0.0	**50.0**	20.1-79.9												50.0	**30.0**	**20.0**			
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Derby (18)	0.0	**0.0**	0.0-21.9							94.4	5.6									
	Saintpaul (11)	0.0	**0.0**	0.0-32.1							100.0										
	Typhimurium var. 5- (10)	30.0	**10.0**	0.5-45.9							50.0	10.0			30.0	**10.0**					

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 8A (continued). Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Swine, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[2]	%R[3]	95% CI[4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Cephems																					
Cefoxitin	Derby (18)	0.0	**0.0**	0.0-21.9									88.9	11.1							
	Saintpaul (11)	0.0	**0.0**	0.0-32.1							18.2	72.7	9.1								
	Typhimurium var. 5- (10)	0.0	**0.0**	0.0-34.5								90.0	10.0								
Ceftiofur	Derby (18)	0.0	**0.0**	0.0-21.9							94.4	5.6									
	Saintpaul (11)	0.0	**0.0**	0.0-32.1						63.6	36.4										
	Typhimurium var. 5- (10)	0.0	**0.0**	0.0-34.5						10.0	90.0										
Ceftriaxone	Derby (18)	0.0	**0.0**	0.0-21.9					100.0												
	Saintpaul (11)	0.0	**0.0**	0.0-32.1					100.0												
	Typhimurium var. 5- (10)	0.0	**0.0**	0.0-34.5					100.0												
Folate Pathway Inhibitors																					
Sulfonamides	Derby (18)	N/A	**44.4**	22.4-68.6												22.2	33.3			**44.4**	
	Saintpaul (11)	N/A	**0.0**	0.0-32.1											81.8	18.2					
	Typhimurium var. 5- (10)	N/A	**60.0**	27.4-86.3												30.0	10.0			**60.0**	
Trimethoprim-Sulfamethoxazole	Derby (18)	N/A	**0.0**	0.0-21.9				77.8	16.7		5.6										
	Saintpaul (11)	N/A	**0.0**	0.0-32.1				100.0													
	Typhimurium var. 5- (10)	N/A	**10.0**	0.5-45.9				90.0						**10.0**							

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 8A (continued). Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Swine, 2010[1]

Antimicrobial	Serotype (# of Isolates)	%I[2]	%R[3]	95% CI[4]	Distribution (%) of MICs (µg/ml)[5] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Penicillins																					
Ampicillin	Derby (18)	0.0	**0.0**	0.0-21.9							94.4	5.6									
	Saintpaul (11)	0.0	**0.0**	0.0-32.1							100.0										
	Typhimurium var. 5- (10)	0.0	**40.0**	13.7-72.6							60.0										
Phenicols																					
Chloramphenicol	Derby (18)	0.0	**0.0**	0.0-21.9										100.0							
	Saintpaul (11)	0.0	**0.0**	0.0-32.1									54.5	45.5							
	Typhimurium var. 5- (10)	0.0	**40.0**	13.7-72.6									20.0	40.0			**40.0**				
Quinolones																					
Ciprofloxacin	Derby (18)	0.0	**0.0**	0.0-21.9	94.4	5.6															
	Saintpaul (11)	0.0	**0.0**	0.0-32.1	100.0																
	Typhimurium var. 5- (10)	0.0	**0.0**	0.0-34.5	90.0	10.0															
Nalidixic Acid	Derby (18)	N/A	**0.0**	0.0-21.9								50.0	50.0								
	Saintpaul (11)	N/A	**0.0**	0.0-32.1								54.5	45.5								
	Typhimurium var. 5- (10)	N/A	**0.0**	0.0-34.5								20.0	80.0								
Tetracyclines																					
Tetracycline	Derby (18)	0.0	**77.8**	51.9-92.6									22.2				**77.8**				
	Saintpaul (11)	0.0	**0.0**	0.0-32.1									100.0								
	Typhimurium var. 5- (10)	0.0	**70.0**	35.4-91.9									30.0			**30.0**	**40.0**				

[1] Data is only presented for serotypes with at least 10 or more isolates

[2] Percent of isolates with intermediate susceptibility

[3] Percent of isolates that were resistant

[4] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[5] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used

Table 9A. Confirmed *S*. Typhimurium DT104[1,2] Isolates, 1997-2010

Year	Chickens			Turkeys			Cattle			Swine		
	n (DT104)	% (All *S*.Typhimurium)	% (Chickens)	n (DT104)	% (All *S*.Typhimurium)	% (Turkeys)	n (DT104)	% (All *S*.Typhimurium)	% (Cattle)	n (DT104)	% (All *S*.Typhimurium)	% (Swine)
1997	4	16.7	1.9	0	0.0	0.0	1	50.0	4.2	11	44.0	9.9
1998	11	16.7	2.0	0	0.0	0.0	2	6.1	0.7	48	45.7	6.1
1999	12	7.8	0.8	2	5.4	0.3	37	19.6	2.3	34	29.8	3.9
2000	18	12.4	1.5	3	16.7	0.6	46	24.6	3.3	25	30.9	5.5
2001	14	10.8	1.1	2	13.3	0.4	20	23.0	2.2	15	34.1	3.6
2002	16	10.7	1.1	1	11.1	0.4	21	21.4	2.1	13	27.1	3.4
2003	4	2.6	0.3	1	16.7	0.4	10	12.8	1.5	8	29.6	3.8
2004	3	1.8	0.2	0	0.0	0.0	14	29.2	2.3	11	20.8	3.6
2005	9	4.9	0.5	2	28.6	0.9	7	20.6	2.1	12	28.6	4.0
2006	8	7.6	0.6	3	60.0	1.0	5	22.7	1.3	8	32.0	2.6
2007	1	1.2	0.1	3	50.0	1.1	7	26.9	1.6	13	29.5	6.2
2008	0	0.0	0.0	0	0.0	0.0	4	14.3	0.9	3	30.0	2.7
2009	0	0.0	0.0	0	0.0	0.0	4	22.2	2.0	7	35.0	5.8
2010	1	1.9	0.2	2	50.0	1.3	5	33.3	2.0	3	23.1	2.7

[1] Includes isolates that are DT104 complex: DT104a, DT104b or U302
[2] Includes *S.* Typhimurium and *S*.Typhimurium variant 5-

Table 10A. MDR *Salmonella* from Chickens, 1997-2010

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	564
Resistance Pattern														
No Resistance Detected	52.8%	58.6%	58.8%	56.9%	66.6%	62.0%	61.1%	62.7%	61.2%	57.2%	53.9%	60.4%	56.1%	49.3%
(Pan-susceptible)	113	329	846	668	871	930	708	803	1217	790	536	377	309	278
Resistance ≥1 CLSI Class[1]	47.2%	41.4%	41.2%	43.1%	33.4%	38.0%	39.2%	37.3%	38.8%	42.8%	46.1%	39.6%	43.9%	50.7%
	101	232	592	505	436	570	454	477	772	590	458	247	242	286
Resistance ≥ 2 CLSI Classes[1]	28.0%	30.7%	31.9%	32.2%	25.2%	28.3%	27.2%	31.2%	31.3%	31.4%	30.2%	33.3%	35.8%	41.7%
	60	172	459	378	330	424	315	399	622	434	300	208	197	235
Resistance ≥ 3 CLSI Classes[1]	9.8%	13.4%	12.3%	15.1%	10.2%	14.2%	13.5%	15.8%	15.1%	16.4%	17.8%	11.4%	15.6%	15.2%
	21	75	177	177	133	213	156	202	301	226	177	71	86	86
Resistance ≥ 4 CLSI Classes[1]	3.3%	3.9%	4.9%	6.7%	3.6%	7.7%	6.8%	9.8%	8.7%	10.3%	12.3%	7.5%	11.1%	11.3%
	7	22	71	79	47	115	79	126	174	142	122	47	61	64
Resistance ≥ 5 CLSI Classes[1]	1.4%	2.7%	3.0%	5.5%	3.1%	5.7%	4.9%	8.0%	5.9%	6.6%	7.4%	6.1%	7.8%	9.0%
	3	15	43	64	41	85	57	103	117	91	74	38	43	51
At Least ACSSuT[2]	1.4%	2.7%	1.7%	4.3%	2.4%	1.9%	1.5%	0.9%	1.6%	1.6%	1.5%	1.4%	1.3%	2.3%
	3	15	24	50	32	29	17	12	31	22	15	9	7	13
At Least ACT/S[3]	0.0%	0.2%	0.1%	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	0	1	2	0	1	0	0	1	2	0	0	0	0	0
At Least ACSSuTAuCx[4]	0.0%	0.5%	0.3%	2.7%	1.1%	0.9%	1.0%	0.4%	0.9%	1.1%	1.4%	1.1%	1.3%	2.0%
	0	3	4	32	14	13	12	5	18	15	14	7	7	11
At Least Ceftriaxone and Nalidixic	0.0%	0.0%	0.1%	0.1%	0.0%	0.5%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Acid Resistant	0	0	1	1	0	8	0	2	1	0	0	0	0	0

Table 11A. MDR *Salmonella* from Turkeys, 1997-2010

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested	107	240	713	518	550	244	262	236	227	304	271	148	121	151
Resistance Pattern														
No Resistance Detected	32.7%	41.3%	32.5%	33.4%	31.6%	29.9%	24.0%	33.5%	27.8%	28.0%	15.5%	21.6%	19.8%	25.2%
(Pan-susceptible)	35	99	232	173	174	73	63	79	63	85	42	32	24	38
Resistance ≥1 CLSI Class[1]	67.3%	58.8%	67.5%	66.6%	68.4%	70.1%	76.0%	66.5%	72.2%	71.4%	84.5%	78.4%	80.2%	74.8%
	72	141	481	345	376	171	199	157	164	219	229	116	97	113
Resistance ≥ 2 CLSI Classes[1]	48.6%	45.0%	53.3%	51.0%	56.2%	46.3%	42.7%	50.0%	53.3%	37.5%	60.1%	55.4%	67.8%	59.6%
	52	108	380	264	309	113	112	118	121	141	163	82	82	90
Resistance ≥ 3 CLSI Classes[1]	25.2%	23.8%	26.2%	21.6%	30.4%	24.2%	21.8%	27.1%	28.2%	27.3%	33.6%	29.7%	33.1%	37.1%
	27	57	187	112	167	59	57	64	64	83	91	44	40	56
Resistance ≥ 4 CLSI Classes[1]	5.6%	6.3%	10.8%	10.0%	14.7%	11.1%	9.5%	10.2%	11.5%	12.2%	15.1%	10.1%	11.6%	17.9%
	6	15	77	52	81	27	25	24	26	37	41	15	14	27
Resistance ≥ 5 CLSI Classes[1]	4.7%	0.8%	5.0%	4.8%	6.0%	6.6%	3.1%	5.5%	6.2%	5.9%	7.0%	4.1%	9.1%	9.3%
	5	2	36	25	33	16	8	13	14	18	19	6	11	14
At Least ACSSuT[2]	3.7%	0.8%	3.8%	3.3%	3.6%	4.5%	2.3%	4.7%	4.0%	3.9%	4.8%	2.0%	3.3%	4.0%
	4	2	27	17	20	11	6	11	9	12	13	3	4	6
At Least ACT/S[3]	0.0%	0.4%	0.4%	0.8%	0.7%	0.8%	0.0%	0.4%	0.0%	0.3%	0.0%	0.0%	0.8%	0.0%
	0	1	3	4	4	2	0	1	0	1	0	0	1	0
At Least ACSSuTAuCx[4]	3.7%	0.4%	3.4%	1.9%	2.9%	1.6%	0.8%	2.1%	1.8%	2.3%	4.1%	2.0%	3.3%	1.3%
	4	1	24	10	16	4	2	5	4	7	11	3	4	2
At Least Ceftriaxone and Nalidixic	1.9%	0.0%	2.7%	1.2%	1.5%	1.2%	0.4%	0.8%	0.9%	0.3%	0.7%	0.0%	0.0%	0.7%
Acid Resistant	2	0	19	6	8	3	1	2	2	1	2	0	0	1

[1]CLSI: Clinical and Laboratory Standards Institute M100 Document
[2]ACSSuT: resistance to at least ampicillin, chloramphenicol, streptomycin, sulfamethoxazole/sulfisoxazole, and tetracycline
[3]ACT/S: resistance to at least ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole
[4]ACSSuTAuCx: resistance to at least ACSSuT, amoxicillin-clavulanic acid, and ceftriaxone

Table 12A. MDR *Salmonella* from Cattle, 1997-2010

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested	24	284	1610	1388	893	1008	670	607	329	389	439	443	200	247
Resistance Pattern														
No Resistance Detected	66.7%	73.2%	74.5%	70.0%	69.9%	64.3%	61.0%	65.6%	63.2%	67.6%	72.0%	68.8%	68.5%	61.1%
(Pan-susceptible)	16	208	1200	972	624	648	409	398	208	263	316	305	137	151
Resistance ≥1 CLSI Class[1]	33.3%	26.8%	25.5%	30.0%	30.1%	35.7%	39.0%	34.4%	36.8%	32.4%	28.0%	31.2%	31.5%	38.9%
	8	76	410	416	269	360	261	209	121	126	123	138	63	96
Resistance ≥ 2 CLSI Classes[1]	20.8%	17.3%	15.8%	21.8%	21.6%	27.9%	31.8%	23.9%	28.6%	26.0%	22.8%	25.7%	26.5%	32.4%
	5	49	254	303	193	281	213	145	94	101	101	114	53	80
Resistance ≥ 3 CLSI Classes[1]	12.5%	13.7%	13.3%	19.8%	18.9%	24.5%	29.6%	21.1%	27.7%	23.9%	22.1%	23.5%	26.0%	28.7%
	3	39	214	275	169	247	198	128	91	93	97	104	52	71
Resistance ≥ 4 CLSI Classes[1]	8.3%	9.2%	10.9%	17.4%	16.9%	22.1%	27.5%	18.8%	24.9%	22.1%	21.0%	21.9%	24.5%	25.5%
	2	26	175	242	151	223	184	114	82	86	92	97	49	63
Resistance ≥ 5 CLSI Classes[1]	8.3%	4.6%	8.0%	14.0%	15.1%	19.3%	23.6%	17.8%	23.1%	20.1%	18.9%	19.0%	20.0%	23.1%
	2	13	128	195	135	195	158	108	76	78	83	84	40	57
At Least ACSSuT[2]	4.2%	4.2%	7.6%	13.1%	14.6%	17.1%	18.1%	16.3%	20.4%	18.3%	16.2%	18.1%	15.0%	18.6%
	1	12	123	182	130	172	121	99	67	71	71	80	30	46
At Least ACT/S[3]	0.0%	2.1%	2.2%	1.7%	2.4%	2.4%	2.7%	1.2%	4.3%	4.1%	2.5%	0.0%	1.5%	4.5%
	0	6	35	23	21	24	18	7	14	16	11	0	3	11
At Least ACSSuTAuCx[4]	0.0%	2.1%	3.7%	8.9%	11.0%	14.6%	15.1%	12.0%	17.3%	16.2%	13.9%	14.7%	9.5%	16.2%
	0	6	59	124	98	147	101	73	57	63	61	65	19	40
At Least Ceftriaxone and Nalidixic	0.0%	0.0%	0.1%	0.1%	0.3%	0.2%	0.4%	1.0%	0.9%	0.3%	0.2%	0.7%	0.0%	1.2%
Acid Resistant	0	0	1	1	3	2	3	6	3	1	1	3	0	3

Table 13A. MDR *Salmonella* from Swine, 1997-2010

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested	111	793	876	451	418	379	211	308	301	304	211	111	120	111
Resistance Pattern														
No Resistance Detected	44.1%	49.2%	48.9%	43.2%	43.5%	40.1%	53.6%	37.3%	44.5%	34.5%	43.1%	47.7%	44.2%	44.1%
(Pan-susceptible)	49	390	428	195	182	152	113	115	134	105	91	53	53	49
Resistance ≥1 CLSI Class[1]	55.9%	50.8%	51.1%	56.8%	56.5%	59.9%	46.4%	62.7%	55.5%	65.5%	56.9%	52.3%	55.8%	55.9%
	62	403	448	256	236	227	98	193	167	199	120	58	67	62
Resistance ≥2 CLSI Classes[1]	43.2%	34.4%	35.3%	44.6%	40.2%	43.3%	34.1%	41.2%	40.5%	36.2%	38.4%	36.9%	35.8%	39.6%
	48	273	309	201	168	164	72	127	122	110	81	41	43	44
Resistance ≥3 CLSI Classes[1]	26.1%	24.0%	26.4%	34.6%	30.6%	34.0%	23.7%	33.4%	31.9%	22.7%	28.0%	29.7%	31.7%	27.9%
	29	190	231	156	128	129	50	103	96	69	59	33	38	31
Resistance ≥4 CLSI Classes[1]	15.3%	11.2%	9.8%	17.1%	9.1%	12.7%	10.9%	15.3%	13.3%	9.5%	17.5%	14.4%	15.0%	11.7%
	17	89	86	77	38	48	23	47	40	29	37	16	18	13
Resistance ≥5 CLSI Classes[1]	4.5%	8.1%	7.3%	9.3%	7.2%	9.0%	9.5%	12.3%	10.3%	5.9%	11.4%	8.1%	14.2%	7.2%
	5	64	64	42	30	34	20	38	31	18	24	9	17	8
At Least ACSSuT[2]	4.5%	7.8%	7.1%	8.6%	7.2%	7.7%	7.6%	12.0%	9.6%	5.3%	10.9%	8.1%	13.3%	7.2%
	5	62	62	39	30	29	16	37	29	16	23	9	16	8
At Least ACT/S[3]	0.0%	0.5%	0.5%	0.0%	1.0%	0.5%	0.9%	0.6%	1.7%	0.3%	1.9%	0.0%	1.7%	0.0%
	0	4	4	0	4	2	2	2	5	1	4	0	2	0
At Least ACSSuTAuCx[4]	0.0%	0.1%	0.5%	1.3%	2.2%	1.8%	1.9%	1.0%	2.7%	0.7%	0.5%	0.9%	1.7%	0.9%
	0	1	4	6	9	7	4	3	8	2	1	1	2	1
At Least Ceftriaxone and Nalidixic	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Acid Resistant	0	0	0	0	0	1	0	0	0	0	0	0	0	0

[1]CLSI: Clinical and Laboratory Standards Institute M100 Document

[2]ACSSuT: resistance to at least ampicillin, chloramphenicol, streptomycin, sulfamethoxazole/sulfisoxazole, and tetracycline

[3]ACT/S: resistance to at least ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole

[4]ACSSuTAuCx: resistance to at least ACSSuT, amoxicillin-clavulanic acid, and ceftriaxone

B. Campylobacter

Table 1B. *Campylobacter* Species Tested from Chickens, 1998-2010[1]

Campylobacter Species	1998 n=194	1999 n=731	2000 n=765	2001 n=116	2002 n=814	2003 n=621	2004 n=694	2005 n=947	2006 n=351	2007 n=242	2008 n=106	2009 n=198	2010 n=308
C. coli	32.5% 63	23.0% 168	22.5% 172	44.8% 52	35.4% 288	39.8% 247	26.8% 186	40.1% 380	35.0% 123	31.4% 76	26.4% 28	40.9% 81	32.5% 100
C. jejuni	66.0% 128	77.0% 563	72.1% 590	55.2% 64	64.6% 526	60.2% 374	73.2% 508	59.9% 567	65.0% 228	68.6% 166	73.6% 78	59.1% 117	67.5% 208
Other	1.5% 3	0.0% 0	0.4% 3	0.0% 0	0.0% 0	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] Differences in isolation methods are described in the section on methods

Figure 1B. *Campylobacter* Species Tested from Chickens, 1998-2010

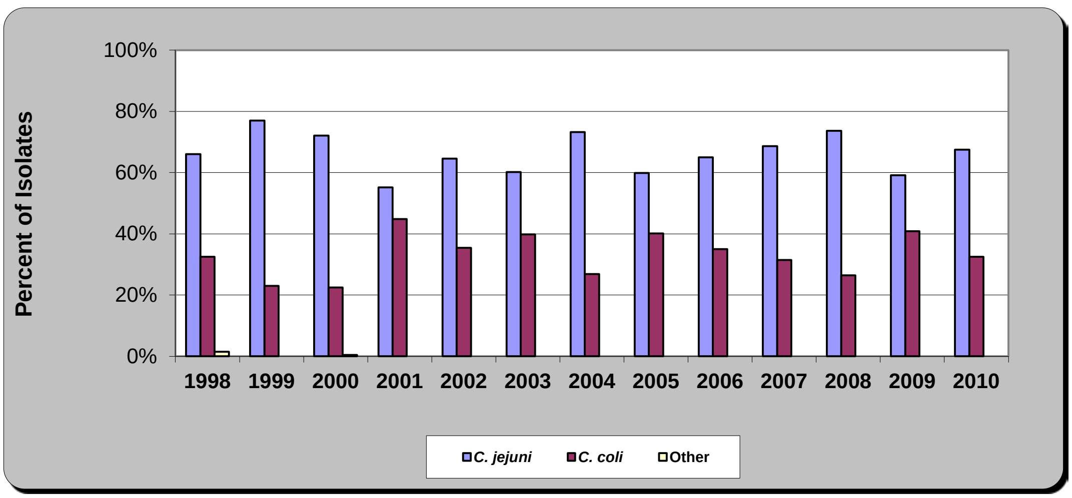


Table 2B. Distribution of MICs and Occurrence of Resistance among *Campylobacter* from Chickens, 2010

Antimicrobial	Isolate Species (# of Isolates) C. coli (100) C. jejuni (208)	%I[1]	%R[2]	95% CI[3]	0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128
					Distribution (%) of MICs (µg/ml)[4]													
Aminoglycosides																		
Gentamicin	*C. coli*	0.0	**5.0**	1.9-11.8					8.0	77.0	10.0						**5.0**	
	C. jejuni	0.0	**0.5**	0-3.1				3.8	31.2	60.1	4.3						**0.5**	
Lincosamides																		
Clindamicin	*C. coli*	0.0	**4.0**	1.3-10.5			2.0	40.0	40.0	13.0		1.0		**3.0**	**1.0**			
	C. jejuni	0.0	**0.0**	0.0-2.3			22.6	57.7	17.8	1.9								
Macrolides/Ketolides																		
Azithromycin	*C. coli*	0.0	**4.0**	1.3-10.5		15.0	56.0	24.0	1.0									**4.0**
	C. jejuni	0.0	**0.0**	0.0-2.3	3.4	45.7	43.8	6.7	0.5									
Erythromycin	*C. coli*	0.0	**4.0**	1.3-10.5				3.0	23.0	29.0	34.0	7.0						**4.0**
	C. jejuni	0.0	**0.0**	0.0-2.3				6.2	34.1	46.6	12.0	1.0						
Telithromycin	*C. coli*	0.0	**4.0**	1.3-10.5				2.0	18.0	6.0	31.0	28.0	11.0		**4.0**			
	C. jejuni	0.0	**0.0**	0.0-2.3				1.4	12.5	46.2	35.6	4.3						
Phenicols																		
Florfenicol	*C. coli*	0.0	**0.0**	0.0-4.6			1.0			10.0	75.0	14.0						
	C. jejuni	0.0	**0.0**	0.0-2.3					0.5	35.6	62.0	1.9						
Quinolones																		
Ciprofloxacin	*C. coli*	0.0	**22.0**	14.6-31.6			18.0	40.0	19.0		1.0			**11.0**	**10.0**	**1.0**		
	C. jejuni	0.0	**23.1**	17.7-29.5		1.9	38.5	31.7	4.8					**12.0**	**10.6**	**0.5**		
Nalidixic acid	*C. coli*	1.0	**22.0**	14.6-31.6									60.0	17.0		**1.0**	**11.0**	**11.0**
	C. jejuni	0.0	**23.1**	17.7-29.5									68.3	8.7			**6.7**	**16.3**
Tetracyclines																		
Tetracycline	*C. coli*	0.0	**56.0**	45.7-65.8			1.0	5.0	22.0	7.0	8.0	1.0				**1.0**	**12.0**	**43.0**
	C. jejuni	1.4	**47.6**	40.7-54.6			1.9	24.5	13.9	4.3	5.8		0.5	1.4	**1.4**	**6.2**	**18.3**	**21.6**

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction method

[4] 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. CLSI breakpoints were used when available.

Table 3B. Antimicrobial Resistance among *Campylobacter* from Chickens, 1998-2010[1,2]

Year			1998	1999	2000	2001[3]	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested		*C. coli*	63	168	172	52	288	247	186	380	123	76	28	81	100
		C. jejuni	128	563	590	64	526	374	508	567	228	166	78	117	208
Antimicrobial Class	**Antimicrobial**	**Isolate Species**													
Aminoglycosides	Gentamicin	*C. coli*	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	1.3% 1	3.6% 1	2.5% 2	5.0% 5
		C. jejuni	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	1.3% 1	0.9% 1	0.5% 1
Lincosamides	Clindamicin	*C. coli*	20.6% 13	12.5% 21	12.8% 22	3.8% 2	8.3% 24	8.9% 22	4.8% 9	2.4% 9	1.6% 2	9.2% 7	3.6% 1	0.0% 0	4.0% 4
		C. jejuni	3.9% 5	0.5% 3	0.2% 1	0.0% 0	0.8% 4	1.1% 4	0.8% 4	0.4% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Macrolides/ Ketolides	Azithromycin	*C. coli*	25.4% 16	14.9% 25	22.7% 39	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	4.0% 4
		C. jejuni	3.1% 4	0.4% 2	0.7% 4	3.1% 2	1.0% 5	1.3% 5	1.6% 8	1.4% 8	0.4% 1	0.0% 0	1.3% 1	0.0% 0	0.0% 0
	Erythromycin	*C. coli*	23.8% 15	14.9% 25	22.7% 39	11.5% 6	18.8% 54	20.2% 50	9.1% 17	8.4% 32	8.9% 11	14.5% 11	10.7% 3	6.2% 5	4.0% 4
		C. jejuni	3.1% 4	0.2% 1	0.5% 3	3.1% 2	0.6% 3	1.6% 6	1.6% 8	1.1% 6	0.4% 1	0.0% 0	1.3% 1	0.0% 0	0.0% 0
	Telithromycin	*C. coli*	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	5.5% 21	6.5% 8	13.2% 10	3.6% 1	6.2% 5	4.0% 4
		C. jejuni	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	0.4% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Phenicols	Chloramphenicol	*C. coli*	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
		C. jejuni	0.0% 0	0.0% 0[4]	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
	Florfenicol	*C. coli*	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		C. jejuni	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Quinolones	Ciprofloxacin	*C. coli*	20.6% 13	13.7% 23	14.5% 25	19.2% 10	16.0% 46	20.2% 50	26.3% 49	22.1% 84	15.4% 19	15.8% 12	14.3% 4	22.2% 18	22.0% 22
		C. jejuni	9.4% 12	9.6% 54	10.5% 62	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	23.1% 44
	Nalidixic acid	*C. coli*	31.7% 20	17.3% 29	16.3% 28	21.2% 11	18.1% 52	21.9% 54	28.0% 52	22.1% 84	15.4% 19	15.8% 12	14.3% 4	22.2% 18	22.0% 22
		C. jejuni	14.8% 19	11.9% 67	12.2% 72	20.3% 13	22.8% 120	15.5% 58	21.7% 110	15.3% 87	8.8% 20	21.7% 36	33.3% 26	19.7% 23	23.1% 48
Tetracyclines	Tetracycline	*C. coli*	61.9% 39	57.7% 97	57.6% 99	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	56.0% 56
		C. jejuni	58.6% 75	53.3% 300	52.9% 312	34.4% 22	44.7% 235	47.1% 176	41.1% 209	44.1% 250	56.1% 128	56.6% 94	53.8% 42	49.6% 58	47.6% 99

[1] From 1998 through 2004, the Etest method was used for susceptibility testing while in 2005 testing was conducted using broth microdilution. For breakpoints, please refer to Table 2 in the sampling and testing methods section. Etest MICs were not rounded up prior to categorization.

[2] From 1998 through 2000, nalidixic acid susceptibility and cephalothin resistance were used as selection criteria for *Campylobacter*

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

[4] One isolate originally found to be chloramphenicol resistant was not reproducible upon further testing

Table 4B. MDR *C. coli* from Chickens, 1998-2010

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested	63	168	172	52	288	247	186	380	123	76	28	81	100
Resistance Pattern													
No Resistance Detected	19.0% 12	33.3% 56	27.9% 48	30.8% 16	37.5% 108	32.8% 81	37.1% 69	47.6% 181	39.0% 48	43.4% 33	28.6% 8	49.4% 40	34.0% 34
Resistance ≥1 CLSI Class[1]	81.0% 51	66.7% 112	72.1% 124	69.2% 36	62.5% 180	67.2% 166	62.9% 117	52.4% 199	61.0% 75	56.6% 43	71.4% 20	50.6% 41	66.0% 66
Resistance ≥2 CLSI Classes[1]	47.6% 30	26.2% 44	29.7% 51	26.9% 14	27.4% 79	32.4% 80	32.3% 60	29.2% 111	22.8% 28	26.3% 20	17.9% 5	19.8% 16	25.0% 25
Resistance ≥3 CLSI Classes[1]	30.2% 19	17.3% 29	18.6% 32	15.4% 8	13.9% 40	18.6% 46	18.3% 34	17.9% 68	16.3% 20	18.4% 14	17.9% 5	6.2% 5	4.0% 4
Resistance ≥4 CLSI Classes[1]	1.6% 1	4.8% 8	3.5% 6	1.9% 1	4.9% 14	3.6% 9	2.7% 5	2.6% 10	1.6% 2	5.3% 4	3.6% 1	4.9% 4	0.0% 0
Resistance ≥5 CLSI Classes[1]	0.0% 0	1.8% 3	0.0% 0	0.0% 0	2.1% 6	0.4% 1	0.5% 1	0.3% 1	0.0% 0	3.9% 3	0.0% 0	0.0% 0	0.0% 0

[1]CLSI: Clinical and Laboratory Standards Institute M100 Document

Table 5B. MDR *C. jejuni* from Chickens, 1998-2010

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested	128	563	590	64	526	374	508	567	228	166	78	117	208
Resistance Pattern													
No Resistance Detected	38.3% 49	42.6% 240	42.2% 249	53.1% 34	44.9% 236	45.5% 170	48.2% 245	46.9% 266	39.9% 91	34.3% 57	33.3% 26	41.9% 49	44.7% 93
Resistance ≥1 CLSI Class[1]	61.7% 79	57.4% 323	57.8% 341	46.9% 30	55.1% 290	54.5% 204	51.8% 263	53.1% 301	60.1% 137	65.7% 109	66.7% 52	58.1% 68	55.3% 115
Resistance ≥2 CLSI Classes[1]	14.8% 19	11.5% 65	11.9% 70	21.9% 14	21.3% 112	16.0% 60	22.0% 112	16.0% 91	8.8% 20	21.7% 36	33.3% 26	12.0% 14	15.9% 33
Resistance ≥3 CLSI Classes[1]	9.4% 12	6.9% 39	6.6% 39	9.4% 6	11.4% 60	8.8% 33	12.2% 62	6.2% 35	5.3% 12	12.7% 21	21.8% 17	0.0% 0	0.0% 0
Resistance ≥4 CLSI Classes[1]	2.3% 3	0.0% 0	0.2% 1	0.0% 0	0.0% 0	0.0% 0	0.4% 2	0.2% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Resistance ≥5 CLSI Classes[1]	1.6% 2	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]CLSI: Clinical and Laboratory Standards Institute M100 Document

C. *Escherichia coli*

Table 1C. Number of *E. coli* Tested from Chickens, 2000-2010

Year										
2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
285	1989	2100	1365	1697	2232	1357	1510	986	877	941

Table 2C. Distribution of MICs and Occurrence of Resistance among *E. coli* from Chickens, 2010

Antimicrobial	%I[1]	%R[2]	95% CI[3]	Distribution (%) of MICs (µg/ml)[4] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Aminoglycosides																				
Amikacin	0.0	**0.0**	0.0-0.5						0.9	26.2	60.9	11.1	1.0							
Gentamicin	9.4	**43.0**	39.8-46.2					4.7	33.5	7.2	0.4	1.8	9.4	**24.7**	**18.4**					
Kanamycin	0.2	**6.4**	5.0-8.2										91.0	2.4	0.2	**0.4**	**6.0**			
Streptomycin	N/A	**49.1**	45.9-52.3												50.9	**21.9**	**27.2**			
β-Lactam/β-Lactamase Inhibitor Combinations																				
Amoxicillin-Clavulanic Acid	1.1	**12.4**	10.4-14.7							3.9	33.7	38.0	10.8	1.1	**11.3**	**1.2**				
Cephems																				
Cefoxitin	2.2	**12.5**	10.5-14.8						0.2	1.5	19.1	52.5	11.9	2.2	**5.4**	**7.1**				
Ceftiofur	2.0	**10.0**	8.2-12.1				3.5	50.8	31.2	1.7	0.7	2.0	**8.1**	**1.9**						
Ceftriaxone	0.1	**12.3**	10.3-14.6					86.8	0.3	0.4	0.1	**1.2**	**5.5**	**5.4**	**0.1**	**0.1**				
Folate Pathway Inhibitors																				
Sulfonamides	N/A	**51.8**	48.6-55.0											32.9	13.8	0.5	0.7	0.2	**51.8**	
Trimethoprim-Sulfamethoxazole	N/A	**6.4**	5.0-8.2				72.6	11.7	5.4	3.3	0.6	**0.1**	**6.3**							
Penicillins																				
Ampicillin	0.0	**22.2**	19.6-25.0							15.1	49.0	13.4	0.3		**0.4**	**21.8**				
Phenicols																				
Chloramphenicol	1.0	**0.7**	0.3-1.5								8.1	61.1	29.1	1.0		**0.7**				
Quinolones																				
Ciprofloxacin	0.0	**0.2**	0-0.8	93.6	2.7	0.3	1.5	1.7					**0.2**							
Nalidixic Acid	N/A	**3.4**	2.4-4.8						1.4	21.4	65.7	7.7	0.4	0.1	**1.0**	**2.4**				
Tetracyclines																				
Tetracycline	2.0	**42.9**	39.7-46.1									55.0	2.0	**0.7**	**7.3**	**34.9**				

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction 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 area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available. There are no CLSI breakpoints for streptomycin; breakpoints established by NARMS were used.

Table 3C. Antimicrobial Resistance among *E. coli* from Chickens, 2000-2010

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested		285	1989	2100	1365	1697	2232	1357	1510	986	877	941
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)											
Aminoglycosides	Amikacin	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		0	0	0	0	0	0	0	0	0	0	0
	Gentamicin	40.0%	33.4%	38.0%	38.8%	39.1%	36.7%	33.1%	38.0%	44.5%	43.3%	43.0%
		114	664	799	530	663	819	449	574	439	380	405
	Kanamycin	16.1%	14.5%	11.6%	10.3%	11.5%	10.3%	9.1%	7.7%	10.2%	7.9%	6.4%
		46	288	243	140	196	231	123	117	101	69	60
	Streptomycin	77.5%	65.8%	65.1%	64.2%	64.1%	58.0%	49.5%	47.0%	54.6%	49.8%	49.1%
		221	1308	1368	877	1088	1295	672	710	538	437	462
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid	8.1%	10.0%	10.9%	11.1%	8.8%	10.6%	16.0%	11.2%	13.7%	12.4%	12.4%
		23	199	229	151	149	236	217	169	135	109	117
Cephems	Cefoxitin	7.4%	8.7%	8.5%	8.3%	8.2%	9.9%	15.0%	10.3%	13.8%	11.4%	12.5%
		21	173	178	113	139	221	204	155	136	100	118
	Ceftriaxone	6.3%	7.6%	8.6%	9.4%	7.2%	9.0%	14.7%	10.3%	13.5%	11.5%	12.3%
		18	152	181	128	122	200	199	155	133	101	116
	Cephalothin	17.9%	12.9%	15.1%	16.6%	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
		51	256	317	226							
	Ceftiofur	6.3%	4.4%	5.5%	7.1%	4.9%	6.5%	10.2%	7.0%	10.5%	9.5%	10.0%
		18	88	115	97	83	145	139	106	103	83	94
Folate Pathway Inhibitors	Sulfonamides[1]	57.9%	58.2%	46.1%	43.9%	53.2%	51.9%	48.6%	53.2%	52.7%	52.6%	51.8%
		165	1157	969	599	903	1159	660	804	520	461	487
	Trimethoprim-Sulfamethoxazole	17.2%	12.6%	10.4%	10.5%	10.7%	10.4%	8.4%	7.9%	9.1%	7.0%	6.4%
		49	251	218	144	181	232	114	120	90	61	60
Penicillins	Ampicillin	20.0%	19.5%	19.0%	18.6%	17.6%	22.0%	25.6%	18.7%	23.5%	19.8%	22.2%
		57	388	399	254	298	492	347	282	232	174	209
Phenicols	Chloramphenicol	4.6%	2.4%	1.8%	1.3%	1.0%	1.0%	1.9%	2.3%	1.0%	1.1%	0.7%
		13	47	38	18	17	22	26	34	10	10	7
Quinolones	Ciprofloxacin	0.0%	0.2%	0.0%	0.1%	0.2%	0.4%	0.0%	0.1%	0.6%	0.5%	0.2%
		0	3	0	1	3	8	0	1	6	4	2
	Nalidixic Acid	10.2%	8.4%	6.8%	6.2%	6.8%	7.5%	5.4%	4.2%	6.0%	3.2%	3.4%
		29	168	142	84	115	168	73	64	59	28	32
Tetracyclines	Tetracycline	68.4%	61.6%	58.6%	52.2%	50.3%	48.9%	49.0%	40.2%	47.4%	49.1%	42.9%
		195	1226	1231	713	853	1092	665	607	467	431	404

[1] Sulfamethoxazole was tested from 1997-2003 and was replaced by sulfisoxazole in 2004

Table 4C. MDR *E. coli* from Chickens, 2000-2010

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested	285	1989	2100	1365	1697	2232	1357	1510	986	877	941
Resistance Pattern											
No Resistance Detected	10.2%	12.9%	15.9%	16.0%	17.0%	17.7%	18.6%	24.4%	20.9%	21.9%	21.5%
	29	257	333	219	288	395	252	367	206	192	202
Resistance ≥1 CLSI Class[1]	89.8%	87.1%	84.1%	84.0%	83.0%	82.3%	81.4%	75.6%	79.1%	78.1%	78.5%
	256	1732	1767	1146	1409	1837	1105	1143	780	685	739
Resistance ≥2 CLSI Classes[1]	76.8%	71.3%	68.1%	65.0%	66.5%	64.7%	62.9%	60.8%	65.4%	65.2%	63.8%
	219	1419	1430	887	1129	1444	854	920	645	572	600
Resistance ≥3 CLSI Classes[1]	55.1%	50.3%	43.9%	39.2%	43.0%	41.5%	43.7%	36.1%	44.1%	41.4%	38.3%
	157	1000	921	535	729	926	593	554	435	363	360
Resistance ≥4 CLSI Classes[1]	19.3%	16.1%	14.3%	13.8%	11.8%	14.9%	17.5%	13.6%	16.6%	14.5%	15.1%
	55	320	300	188	200	333	237	206	164	127	142
Resistance ≥5 CLSI Classes[1]	8.1%	8.1%	7.4%	7.2%	5.8%	7.6%	8.9%	7.1%	9.0%	7.5%	8.2%
	23	162	155	98	98	170	121	107	89	66	77

[1]CLSI: Clinical and Laboratory Standards Institute M100 Document

D. Enterococcus

Table 1D. Number of *Enterococcus* Isolates Tested from Chickens, 2003-2010

Animal Source	2003	2004	2005	2006	2007	2008	2009	2010
Chickens	2043	2456	3035	2120	1571	916	832	948

Table 2D. *Enterococcus* Species Tested from Chickens, 2010

Species	n	%
Faecalis	420	44.3
Faecium	285	30.1
Durans	71	7.5
Hirae	56	5.9
Casseliflavus	42	4.4
Gallinarum	30	3.2
Avium	20	2.1
Ent.species	9	0.9
Cecorum	7	0.7
Gilvus	5	0.5
Malodoratus	3	0.3
Total	**948**	**100.0**

Figure 1D. *Enterococcus* Species Percent Distribution by Year in Relation to Top Species Identified in 2010

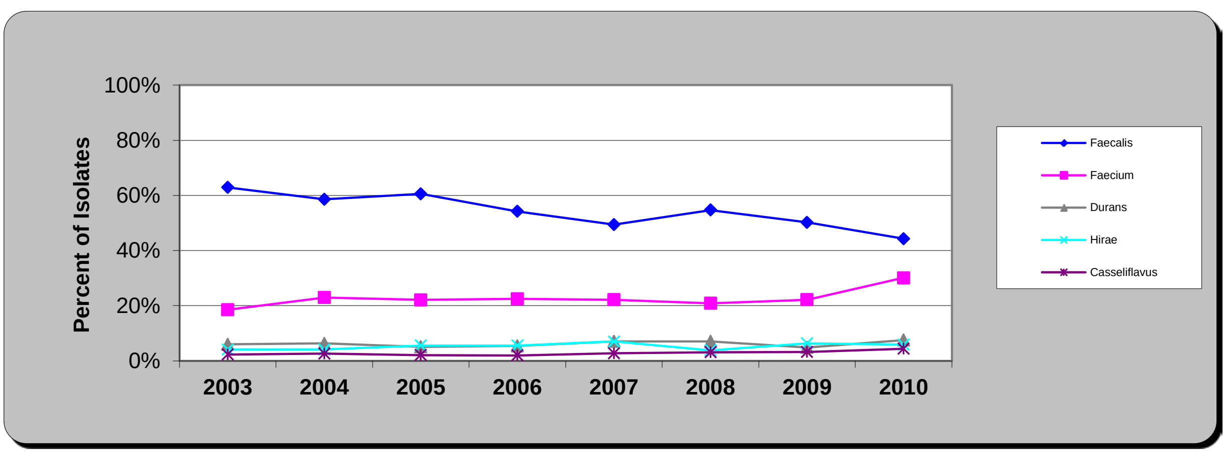


Table 3D. Distribution of MICs and Occurrence of Resistance among *Enterococcus* from Chickens, 2010

Antimicrobial	%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	2048	4096
Aminoglycosides																						
Gentamicin	N/A	**25.8**	23.1-28.7														73.1	1.1	**0.5**	**3.1**	**22.3**	
Kanamycin	N/A	**29.9**	27.0-32.9														57.3	10.1	2.7	**1.6**	**28.3**	
Streptomycin	N/A	**19.7**	17.2-22.4																80.3	**3.2**	**5.3**	**11.3**
Glycopeptide																						
Vancomycin	2.6	**0.0**	0.0-0.5					0.4	28.4	45.1	21.2	2.2	2.6									
Glycylcycline																						
Tigecycline	N/A	**0.0**	0.0-0.5	1.0	4.0	15.4	43.7	35.9														
Lincosamides																						
Lincomycin	0.3	**95.1**	93.5-96.3							4.1	0.4	0.3	**1.4**	**93.8**								
Lipopeptides																						
Daptomycin	N/A	**0.6**	0.2-1.4					6.5	15.4	38.2	17.3	21.9	**0.6**									
Macrolides																						
Erythromycin	28.5	**33.8**	30.8-36.9					28.1	9.7	17.1	8.8	2.6	**1.9**	**31.9**								
Tylosin	0.3	**33.2**	30.2-36.3					0.1	0.7	6.6	40.5	14.9	3.6	0.3		**33.2**						
Nitrofuran																						
Nitrofurantoin	19.6	**23.0**	20.4-25.8								0.2	2.0	29.9	20.7	4.6	19.6	**23.0**					
Oxazolidinone																						
Linezolid	0.0	**0.0**	0.0-0.5						0.6	77.1	22.3											
Penicillin																						
Penicillin	0	**9.3**	7.6-11.4					7.3	4.4	7.8	15.8	48.1	7.3	**5.1**	**4.2**							
Phenicol																						
Chloramphenicol	0.4	**0.0**	0.0-0.5								0.7	23.7	75.1	0.4								
Quinolone																						
Ciprofloxacin	20.9	**11.2**	9.3-13.4				0.3	5.9	12.2	49.5	20.9	**9.7**	**1.5**									
Streptogramin																						
Quinupristin/Dalfopristin[5]	50.8	**32.4**	28.5-36.6						9.7	7.2	50.8	**9.7**	**15.9**	**6.1**	**0.8**							
Tetracyclines																						
Tetracycline	1.8	**73.1**	70.1-75.9							24.6	0.5		1.8	**1.8**	**6.2**	**65.1**						

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

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

[4] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available.

[5] *E.faecalis* excluded from Quinuspristin/Dalfopristin results

Table 4D. Antimicrobial Resistance among *Enterococcus* from Chickens, 2003-2010

Year		2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested		2043	2456	3035	2120	1571	916	832	948
Antimicrobial Class	**Antimicrobial**								
Aminoglycosides	Gentamicin	463 22.7%	547 22.3%	647 21.3%	441 20.8%	360 22.9%	255 27.8%	205 24.6%	245 25.8%
	Kanamycin	666 32.6%	752 30.6%	950 31.3%	620 29.2%	487 31.0%	340 37.1%	232 27.9%	283 29.9%
	Streptomycin	403 19.7%	419 17.1%	658 21.7%	330 15.6%	199 12.7%	136 14.8%	134 16.1%	187 19.7%
Glycopeptide	Vancomycin	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Glycylcycline	Tigecycline	Not Tested	Not Tested	Not Tested	3 0.1%	13 0.8%	3 0.3%	7 0.8%	0 0.0%
Lincosamides	Lincomycin	1995 97.7%	2330 94.9%	2911 95.9%	1983 93.5%	1473 93.8%	861 94.0%	772 92.8%	902 95.1%
Lipopeptide	Daptomycin	Not Tested	40 1.6%	21 0.7%	3 0.1%	4 0.3%	1 0.1%	6 0.7%	6 0.6%
Macrolide	Erythromycin	748 36.6%	833 33.9%	1075 35.4%	841 39.7%	544 34.6%	367 40.1%	290 34.9%	320 33.8%
	Tylosin	754 36.9%	834 34.0%	1071 35.3%	840 39.6%	511 32.5%	365 39.8%	284 34.1%	315 33.2%
Nitrofurans	Nitrofurantoin	294 14.4%	493 20.1%	525 17.3%	379 17.9%	284 18.1%	165 18.0%	135 16.2%	218 23.0%
Oxazolidinones	Linezolid	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	Penicillin	172 8.4%	205 8.3%	253 8.3%	147 6.9%	135 8.6%	76 8.3%	69 8.3%	88 9.3%
Phenicols	Chloramphenicol	4 0.2%	2 0.1%	3 0.1%	6 0.3%	6 0.4%	3 0.3%	2 0.2%	0 0.0%
Quinolones	Ciprofloxacin	96 4.7%	243 9.9%	222 7.3%	188 8.9%	113 7.2%	92 10.0%	82 9.9%	106 11.2%
Streptogramins	Quinupristin/Dalfopristin[1]	284 37.5%	314 30.9%	374 31.3%	349 36.0%	202 25.4%	111 26.7%	151 36.5%	171 32.4%
Tetracyclines	Tetracycline	1462 71.6%	1771 72.1%	2129 70.1%	1580 74.5%	1095 69.7%	677 73.9%	613 73.7%	693 73.1%

[1]*E. faecalis* (n=420 in 2010) excluded from Quinuspristin/Dalfopristin results

Table 5D. Distribution of MICs and Occurrence of Resistance for Top *Enterococcus* Species Tested from Chickens, 2010

Antimicrobial	Species (# 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	2048	4096
Aminoglycosides																							
Gentamicin	Faecalis (420)	0.0	**34.8**	30.3-39.6														65.0	0.2	**0.5**	**2.9**	**31.4**	
	Faecium (285)	0.0	**14.7**	10.9-19.5														84.6	0.7		**0.7**	**14.0**	
	Durans (71)	0.0	**0.0**	0.0-6.4														100.0					
	Hirae (56)	0.0	**8.9**	3.3-20.3														89.3	1.8		**1.8**	**7.1**	
	Casseliflavus (42)	0.0	**47.6**	32.3-63.4														47.6	4.8	**4.8**	**9.5**	**33.3**	
	Gallinarum (30)	0.0	**76.7**	57.3-89.4														13.3	10.0		**23.3**	**53.3**	
	Avium (20)	0.0	**40.0**	20.0-63.6														55.0	5.0	**5.0**	**15.0**	**20.0**	
Kanamycin	Faecalis (420)	N/A	**39.8**	35.1-44.7														59.5	0.5	0.2	**0.2**	**39.5**	
	Faecium (285)	N/A	**15.8**	11.9-20.7														44.6	31.9	7.7	**2.1**	**13.7**	
	Durans (71)	N/A	**1.4**	0.1-8.6														95.8	2.8			**1.4**	
	Hirae (56)	N/A	**8.9**	3.3-20.3														89.3	1.8			**8.9**	
	Casseliflavus (42)	N/A	**59.5**	43.3-74.0														35.7		4.8	**2.4**	**57.1**	
	Gallinarum (30)	N/A	**90.0**	72.3-97.4														6.7		3.3	**6.7**	**83.3**	
	Avium (20)	N/A	**60.0**	36.4-80.0														40.0			**20.0**	**40.0**	
Streptomycin	Faecalis (420)	N/A	**19.5**	15.9-23.7																80.5	**0.5**	**2.6**	**16.4**
	Faecium (285)	N/A	**26.0**	21.1-31.6																74.0	**9.5**	**12.6**	**3.9**
	Durans (71)	N/A	**5.6**	1.8-14.5																94.4	**1.4**		**4.2**
	Hirae (56)	N/A	**5.4**	1.4-15.9																94.6		**1.8**	**3.6**
	Casseliflavus (42)	N/A	**21.4**	10.8-37.2																78.6			**21.4**
	Gallinarum (30)	N/A	**33.3**	17.9-52.8																66.7		**6.7**	**26.7**
	Avium (20)	N/A	**20.0**	6.6-44.3																80.0			**20.0**
Glycopeptide																							
Vancomycin	Faecalis (420)	0.2	**0.0**	0.0-1.1						0.5	66.4	32.4	0.5	0.2									
	Faecium (285)	0.0	**0.0**	0.0-1.7						50.9	35.1	14.0											
	Durans (71)	0.0	**0.0**	0.0-6.4					2.8	94.4	2.8												
	Hirae (56)	0.0	**0.0**	0.0-8.0						33.9	66.1												
	Casseliflavus (42)	16.7	**0.0**	0.0-10.4					2.4	4.8	9.5	52.4	14.3	16.7									
	Gallinarum (30)	53.3	**0.0**	0.0-14.1						3.3	3.3		40.0	53.3									
	Avium (20)	0.0	**0.0**	0.0-20.0					5.0	80.0	15.0												

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

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

[4] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available.

Table 5D (continued). Distribution of MICs and Occurrence of Resistance for Top *Enterococcus* Species Tested from Chickens, 2010

Antimicrobial	Species (# 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	2048	4096
Glycylcycline																							
Tigecycline	Faecalis (420)	N/A	**0.0**	**0.0-1.1**	0.2	0.7	10.7	39.5	48.8														
	Faecium (285)	N/A	**0.0**	**0.0-1.7**	1.1	8.8	23.2	43.5	23.5														
	Durans (71)	N/A	**0.0**	**0.0-6.4**		1.4	12.7	59.2	26.8														
	Hirae (56)	N/A	**0.0**	**0.0-8.0**		10.7	19.6	51.8	17.9														
	Casseliflavus (42)	N/A	**0.0**	**0.0-10.7**	2.4		12.2	51.2	34.1														
	Gallinarum (30)	N/A	**0.0**	**0.0-14.1**		3.3	10.0	30.0	56.7														
	Avium (20)	N/A	**0.0**	**0.0-20.0**		10.0	10.0	60.0	20.0														
Lincosamides																							
Lincomycin	Faecalis (420)	0.0	**99.5**	98.1-99.9							0.2	0.2			**99.5**								
	Faecium (285)	0.4	**87.7**	83.2-91.2							11.2	0.7	0.4	**1.1**	**86.7**								
	Durans (71)	0.0	**100.0**	93.6-100										**2.8**	**97.2**								
	Hirae (56)	0.0	**98.2**	89.2-99.9							1.8				**98.2**								
	Casseliflavus (42)	0.0	**100.0**	89.6-100										**9.5**	**90.5**								
	Gallinarum (30)	0.0	**100.0**	85.9-100											**100.0**								
	Avium (20)	0.0	**95.0**	73.1-99.7							5.0			**10.0**	**85.0**								
Lipopeptides																							
Daptomycin	Faecalis (420)	N/A	**0.0**	0.0-1.1					0.7	12.9	75.0	10.7	0.7										
	Faecium (285)	N/A	**2.1**	0.9-4.7							5.3	26.0	66.7	**2.1**									
	Durans (71)	N/A	**0.0**	0.0-6.4					38.0	52.1	5.6	4.2											
	Hirae (56)	N/A	**0.0**	0.0-8.0							26.8	51.8	21.4										
	Casseliflavus (42)	N/A	**0.0**	0.0-10.4					21.4	76.2	2.4												
	Gallinarum (30)	N/A	**0.0**	0.0-14.1						16.7	33.3	40.0	10.0										
	Avium (20)	N/A	**0.0**	0.0-20.0					20.0	75.0	5.0												
Macrolides																							
Erythromycin	Faecalis (420)	30.5	**42.4**	37.6-47.3					19.3	7.9	25.0	4.8	0.7	**1.4**	**41.0**								
	Faecium (285)	41.4	**21.4**	16.9-26.7					26.3	10.9	17.2	18.2	6.0	**2.8**	**18.6**								
	Durans (71)	1.4	**57.7**	45.4-69.1					40.8				1.4	**4.2**	**53.5**								
	Hirae (56)	0.0	**17.9**	9.4-30.9					82.1					**1.8**	**16.1**								
	Casseliflavus (42)	31.0	**31.0**	18.2-47.3					11.9	26.2	19.0	9.5	2.4		**31.0**								
	Gallinarum (30)	6.7	**30.0**	15.4-49.6					16.7	46.7		6.7			**30.0**								
	Avium (20)	0.0	**25.0**	9.6-49.4					75.0						**25.0**								
Tylosin	Faecalis (420)	0.0	**43.3**	38.5-48.2						0.2	3.1	51.4	1.9				**43.3**						
	Faecium (285)	0.4	**17.5**	13.4-22.5						0.4	7.7	22.8	40.0	11.2	0.4		**17.5**						
	Durans (71)	0.0	**54.9**	42.7-66.6						2.8	7.0	26.8	5.6	2.8			**54.9**						
	Hirae (56)	1.8	**17.9**	9.4-30.9							1.8	67.9	10.7		1.8		**17.9**						
	Casseliflavus (42)	0.0	**33.3**	20.0-49.6							4.8	61.9					**33.3**						
	Gallinarum (30)	0.0	**36.7**	20.6-56.1							40.0	23.3					**36.7**						
	Avium (20)	0.0	**25.0**	9.6-49.4							10.0	25.0	40.0				**25.0**						

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

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

[4] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available.

Table 5D (continued). Distribution of MICs and Occurrence of Resistance for Top *Enterococcus* Species Tested from Chickens, 2010

Antimicrobial	Species (# 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	2048	4096
Nitrofuran																							
Nitrofurantoin	Faecalis (420)	2.1	**1.0**	0.3-2.7									0.7	57.1	38.8	0.2	2.1	**1.0**					
	Faecium (285)	47.7	**49.5**	43.6-55.4										0.7		2.1	47.7	**49.5**					
	Durans (71)	8.5	**88.7**	78.4-94.6												2.8	8.5	**88.7**					
	Hirae (56)	44.6	**7.1**	2.3-18.1											1.8	46.4	44.6	**7.1**					
	Casseliflavus (42)	0.0	**0.0**	0.0-10.4									2.4	54.8	40.5	2.4							
	Gallinarum (30)	0.0	**3.3**	0.2-19.0									26.7	46.7	23.3			**3.3**					
	Avium (20)	45.0	**10.0**	1.8-33.1										5.0	5.0	35.0	45.0	**10.0**					
Oxazolidinone																							
Linezolid	Faecalis (420)	0.0	**0.0**	0.0-1.1							68.1	31.9											
	Faecium (285)	0.0	**0.0**	0.0-1.7						0.4	77.2	22.5											
	Durans (71)	0.0	**0.0**	0.0-6.4						1.4	91.5	7.0											
	Hirae (56)	0.0	**0.0**	0.0-8.0							87.5	12.5											
	Casseliflavus (42)	0.0	**0.0**	0.0-10.4							100.0												
	Gallinarum (30)	0.0	**0.0**	0.0-14.1							100.0												
	Avium (20)	0.0	**0.0**	0.0-20.0							100.0												
Penicillin																							
Penicillin	Faecalis (420)	N/A	**0.5**	0.1-1.9					0.2		0.5	20.2	78.3	0.2	**0.2**	**0.2**							
	Faecium (285)	N/A	**25.6**	20.7-31.2					9.1	1.8	3.2	11.9	36.5	11.9	**13.3**	**12.3**							
	Durans (71)	N/A	**5.6**	1.8-14.5					19.7	11.3	14.1	5.6	7.0	36.6	**5.6**								
	Hirae (56)	N/A	**10.7**	4.4-22.5					21.4	1.8	37.5	16.1	12.5		**3.6**	**7.1**							
	Casseliflavus (42)	N/A	**0.0**	0.0-10.4					26.2	50.0	23.8												
	Gallinarum (30)	N/A	**3.3**	0.2-19.0							53.3	3.3	16.7	23.3	3.3								
	Avium (20)	N/A	**0.0**	0.0-20.0						5.0	10.0	60.0	25.0										
Phenicol	Faecalis (420)	1.0	**0.0**	0.0-1.1									2.1	96.9	1.0								
Chloramphenicol	Faecium (285)	0.0	**0.0**	0.0-1.7									35.8	64.2									
	Durans (71)	0.0	**0.0**	0.0-6.4									32.4	67.6									
	Hirae (56)	0.0	**0.0**	0.0-8.0									75.0	25.0									
	Casseliflavus (42)	0.0	**0.0**	0.0-10.4									19.0	81.0									
	Gallinarum (30)	0.0	**0.0**	0.0-14.1									60.0	40.0									
	Avium (20)	0.0	**0.0**	0.0-20.0									50.0	50.0									

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

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

[4] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available.

Table 5D (continued). Distribution of MICs and Occurrence of Resistance for Top *Enterococcus* Species Tested from Chickens, 2010

Antimicrobial	Species (# 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	2048	4096
Quinolone																							
Ciprofloxacin	Faecalis (420)	13.3	**0.2**	0-1.5					0.2	5.5	80.7	13.3	**0.2**										
	Faecium (285)	38.2	**36.8**	31.2-42.7					0.4	2.1	22.5	38.2	**31.9**	**4.9**									
	Durans (71)	0.0	**0.0**	0.0-6.4					28.2	67.6	4.2												
	Hirae (56)	0.0	**0.0**	0.0-8.0				3.6	48.2	46.4	1.8												
	Casseliflavus (42)	47.6	**0.0**	0.0-10.4							52.4	47.6											
	Gallinarum (30)	23.3	**0.0**	0.0-14.1					3.3	16.7	56.7	23.3											
	Avium (20)	15.0	**0.0**	0.0-20.0						5.0	80.0	15.0											
Streptogramin																							
Quinupristin/Dalfopristin	Faecalis (420)	N/A	**N/A**	N/A																			
	Faecium (285)	39.6	**44.9**	39.1-50.9						10.5	4.9	39.6	**8.4**	**24.2**	**10.9**	**1.4**							
	Durans (71)	73.2	**11.3**	5.4-21.6						1.4	14.1	73.2	**7.0**	**4.2**									
	Hirae (56)	66.1	**28.6**	17.7-42.4						1.8	3.6	66.1	**8.9**	**17.9**	**1.8**								
	Casseliflavus (42)	73.8	**23.8**	12.6-39.8						2.4		73.8	**23.8**										
	Gallinarum (30)	63.3	**13.3**	4.3-31.6							23.3	63.3	**13.3**										
	Avium (20)	70.0	**5.0**	0.3-26.9						10.0	15.0	70.0	**5.0**										
Tetracyclines																							
Tetracycline	Faecalis (420)	0.2	**82.4**	78.3-85.9							16.9	0.5		0.2	**1.4**	**7.6**	**73.3**						
	Faecium (285)	4.9	**62.8**	56.9-68.4							31.9	0.4		4.9	**3.2**	**2.8**	**56.8**						
	Durans (71)	1.4	**73.2**	61.2-82.7							25.4			1.4	**1.4**	**7.0**	**64.8**						
	Hirae (56)	0.0	**67.9**	54.0-79.4							30.4	1.8				**3.6**	**64.3**						
	Casseliflavus (42)	0.0	**59.5**	43.3-74.0							40.5						**59.5**						
	Gallinarum (30)	0.0	**93.3**	76.4-98.8							6.7					**10.0**	**83.3**						
	Avium (20)	0.0	**75.0**	50.6-90.4							25.0					**45.0**	**30.0**						

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

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

[4] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration. CLSI breakpoints were used when available.

Table 6D. MDR *Enterococcus faecalis* from Chickens, 2003-2010

Species	*E. faecalis*							
Year	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested	1285	1440	1839	1150	776	501	418	420
Resistance Pattern								
No Resistance detected	0.1% 1	0.4% 6	0.1% 2	0.0% 0	0.0% 0	0.2% 1	1.0% 4	0.5% 2
Resistance ≥1 CLS Class[1]	99.9% 1284	99.6% 1434	99.9% 1837	100.0% 1150	100.0% 776	99.8% 500	99.0% 414	99.5% 418
Resistance ≥2 CLSI Classes[1]	84.5% 1086	85.5% 1231	83.0% 1526	88.1% 1013	85.3% 662	89.8% 450	87.8% 367	89.5% 376
Resistance ≥3 CLSI Clasess[1]	50.8% 653	52.3% 753	51.2% 941	58.7% 675	51.4% 399	57.9% 290	52.9% 221	54.8% 230
Resistance ≥4 CLSI Classes[1]	22.5% 289	22.9% 330	23.1% 424	28.4% 327	22.9% 178	29.5% 148	23.4% 98	27.1% 114
Resistance ≥5 CLSI Classes[1]	0.0% 0	0.8% 11	0.5% 9	1.0% 12	0.9% 7	0.6% 3	0.2% 1	0.2% 1

[1]CLSI: Clinical and Laboratory Standards Institute M100 Document

Table 7D. MDR *Enterococcus faecium* from Chickens, 2003-2010

Species	*E. faecium*							
Year	2003	2004	2005	2006	2007	2008	2009	2010
Number of Isolates Tested	377	564	670	477	349	191	185	285
Resistance Pattern								
No Resistance detected	0.9% 11	1.2% 17	2.2% 41	2.7% 31	3.4% 12	3.1% 6	3.2% 6	3.2% 9
Resistance ≥1 CLS Class[1]	28.5% 366	38.0% 547	34.2% 629	38.8% 446	96.6% 337	96.9% 185	96.8% 179	96.8% 276
Resistance ≥2 CLSI Classes[1]	26.3% 338	34.8% 501	31.4% 578	36.2% 416	87.4% 305	89.0% 170	90.3% 167	84.6% 241
Resistance ≥3 CLSI Clasess[1]	21.5% 276	28.8% 414	26.3% 483	31.1% 358	71.6% 250	78.0% 149	78.9% 146	71.6% 204
Resistance ≥4 CLSI Classes[1]	15.9% 204	21.2% 305	20.1% 370	23.7% 272	53.6% 187	61.3% 117	64.9% 120	56.8% 162
Resistance ≥5 CLSI Classes[1]	9.8% 126	12.8% 184	13.8% 254	15.0% 173	30.7% 107	43.5% 83	48.1% 89	34.4% 98

[1]CLSI: Clinical and Laboratory Standards Institute M100 Document

Appendix A. Distribution of MICs and Occurrence of Resistance to Ciprofloxacin, by Year and Animal Source, 1997-2010

Isolate Source	Year (# 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
Chickens	1997 (214)	0	0	0.0-2.2	92.1	7.9								
	1998 (561)	0	0	0-1.2	67.6	31.7	0.5				0.2			
	1999 (1438)	0.1	0	0-0.5	63.7	35	1		0.2		0.1			
	2000 (1173)	0.4	0	0.0-0.4	94.9	4.1	0.4	0.4	0.2					
	2001 (1307)	0.3	0	0.0-0.4	93.6	6.3	0.1							
	2002 (1500)	0.3	0	0-0.5	95.6	3.5	0.1	0.3	0.4	0.1	0.1			
	2003 (1158)	0.6	0	0-0.6	98.1	1.6		0.1		0.2				0.1
	2004 (1280)	1.8	0	0.0-0.4	98.2	1.4		0.3	0.1					
	2005 (1989)	1.5	0	0.0-0.2	96.2	3.5	0.1	0.2	0.1					
	2006 (1380)	0.3	0.3	0.0-0.3	95.7	3.5	0.7	0.1						
	2007 (994)	0.7	0	0.0-0.5	79.6	18.3	2	0.1						
	2008 (624)	0.7	0	0.0-0.8	93.4	6.4	0.2							
	2009 (551)	1	0	0.0-0.9	90.4	9.6								
	2010 (564)	2.8	0	0.0-0.8	84	16								
Turkeys	1997 (107)	0	0	0.0-4.3	77.6	15.9	3.7		2.8					
	1998 (240)	0	0.2	0-2.6	60.4	35.4	2.1		1.2	0.4	0.4			
	1999 (713)	0.2	0.1	0.0-0.7	58.2	35.3	1.1	0.4	3.8	1.1				
	2000 (518)	0.6	0	0.1-1.6	86.3	7.3	1	0.4	3.3	1.4	0.4			
	2001 (550)	0	0	0-1.2	83.3	11.1	0.5	0.9	2.2	1.8	0.2			
	2002 (244)	0.7	0.1	0-2.6	89.3	5.3		0.4	2.9	1.6	0.4			
	2003 (262)	0.3	0.1	0.0-1.8	92.7	3.4	0.8	1.9	1.1					
	2004 (236)	0.4	0	0.0-2.0	94.1	3.4	0.4		1.7	0.4				
	2005 (227)	0.3	0	0.0-2.1	91.2	6.6			1.8	0.4				
	2006 (304)	0.1	0	0.0-1.6	95.7	3.6		0.7						
	2007 (271)	0.1	0	0.0-1.7	74.5	21.8	2.6		0.7	0.4				
	2008 (148)	0	0	0.0-3.2	95.3	4.1		0.7						
	2009 (121)	0	0	0.0-3.8	97.5	1.7			0.8					
	2010 (151)	0	0	0.0-3.1	96.7	1.3	1.3		0.7					
Cattle	1997 (24)	0	0	0.0-17.2	83.3	16.7								
	1998 (284)	0	0	0.0-1.7	71.5	27.1	1.4							
	1999 (1610)	0	0	0.0-0.3	58.4	40.7	0.7		0.1	0.1				
	2000 (1388)	0	0	0.0-0.3	95	4.3	0.2		0.4	0.1				
	2001 (893)	0	0	0.0-0.5	95.1	4	0.6		0.3					
	2002 (1008)	0.3	0	0.0-0.5	93.2	5.8	0.8	0.1	0.1	0.1				
	2003 (670)	0	0	0.0-0.7	96.1	3.3		0.1	0.4					
	2004 (607)	0	0	0.0-0.8	96.7	1.3	0.2	0.3	0.8	0.7				
	2005 (329)	0.3	0	0.0-1.4	92.1	6.4		0.3	0.9	0.3				
	2006 (389)	0	0	0-1.7	96.4	2.8	0.3	0.3			0.3			
	2007 (439)	0	0	0.0-1.1	79	18.7	1.6	0.2		0.5				
	2008 (443)	0	0	0.0-1.1	91.9	7	0.5		0.7					
	2009 (200)	0	0	0.0-2.3	95.5	3	0.5		0.5	0.5				
	2010 (247)	0	0	0.0-1.9	87	10.1			2.4	0.4				
Swine	1997 (111)	2.8	0	0.0-4.2	78.4	18.9	2.7							
	1998 (793)	1.7	0.4	0.0-0.6	64.1	34.8	1.1							
	1999 (876)	5.3	0	0.0-0.5	61.2	37.6	1.3							
	2000 (451)	5	0.4	0.0-1.1	93.3	5.8	0.9							
	2001 (418)	4.9	0.2	0.0-1.1	88.3	11.7								
	2002 (379)	4.9	0.4	0.0-1.3	93.7	5.5	0.5	0.3						
	2003 (211)	3.1	0	0.0-2.2	94.8	5.2								
	2004 (308)	2.1	0	0.0-1.5	96.1	3.9								
	2005 (301)	2.2	0	0.0-1.6	92	7.6			0.3					
	2006 (304)	0.7	0	0.0-1.6	95.1	4.3	0.7							
	2007 (211)	1.1	0	0.0-2.2	81.5	17.5	0.9							
	2008 (111)	0.7	0	0.0-4.2	95.5	4.5								
	2009 (120)	0.8	0	0.0-3.9	92.5	7.5								
	2010 (111)	0.7	0	0.0-4.2	95.5	2.7	1.8							

[1] Percent of isolates with intermediate susceptibility according to the new breakpoints to be applied in the 2011 Report, Intermediate (I): MIC=0.12-0.5 µg/ml

[2] Percent of isolates that were resistant according to the new breakpoints to be applied in the 2011 Report, Resistant (R): MIC ≥1 µg/ml

[3] 95% confidence intervals for percent resistant (%R) were calculated using the Wilson interval with continuity correction 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 area indicate the percentages of isolates with MICs greater than the highest tested concentrations. Numbers listed for the lowest tested concentrations represent the percentages of isolates with MICs equal to or less than the lowest tested concentration.