NARMS

National Antimicrobial Resistance Monitoring System

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

2011

Annual Animal Report

USDA

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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 on human therapeutic values although molecular mechanisms of resistance or treatment patterns may also influence selection. Non-Typhi *Salmonella* was chosen as the sentinel organism of the NARMS program. Testing of *Campylobacter, Escherichia coli* (generic) and *Enterococcus* isolates from animals began in 1998, 2000 and 2003, respectively.

This report summarizes 2011 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. Other analyses are available upon request.

Suggested Citation: USDA. National Antimicrobial Resistance Monitoring System – Enteric Bacteria, Animal Arm (NARMS): 2011 NARMS Animal Arm Annual Report. Athens, GA: U.S. Department of Agriculture, Agricultural Research Service, 2014.

The 2010 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 (MLG), 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 MLG.[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.

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

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[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. 2011. Isolation and Identification of *Salmonella* from Meat, Poultry, and Egg Products. Microbiological Lab Guidebook 4.05. Available at http://www.fsis.usda.gov/PDF/MLG_4_05.pdf.

[4] USDA/FSIS. 2012. Laboratories and Procedures. Available at 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.

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. Effective July 2011, FSIS implemented new *Campylobacter* performance standards for whole carcasses of young chickens (broilers) and began the isolation, identification and enumeration of *Campylobacter* as described in the FSIS MLG.[6] Hence, this report summarizes results for *Campylobacter* isolates cultured by ARS from January 2011 through June 2011 as described above, and for *Campylobacter* isolates cultured by FSIS qualitative analysis from July 2011 through December 2011. 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.[7] Confirmed *Enterococcus* isolates of other species not identified with this procedure were labeled as *'Enterococcus* species*'.*

C. Antimicrobial Susceptibility

In 2011, *Salmonella*, *Campylobacter*, *E. coli* and *Enterococcus* were tested using a semi-automated broth microdilution system (Sensititre®, Trek Diagnostic Systems, Inc., Thermo Fisher Scientific; Oakwood Village, OH) and a custom made 96-well panel of antimicrobials (catalog no. CMV2AGNF 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

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[6] USDA/FSIS. 2011. Isolation Identification and Enumeration of *Campylobacter jejuni/coli/lari* from Poultry Rinse and Sponge Samples. Microbiological Lab Guidebook 41.01. Available at http://www.fsis.usda.gov/PDF/MLG_41_01.pdf.

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

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*.[8]

Regardless of the susceptibility testing method used, antimicrobial resistance was determined using Clinical and Laboratory Standards Institute (CLSI) breakpoints, when available.[9,10,11]

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 *Enterococcu*s testing, *Enterococcus faecalis* ATCC 29212 and ATCC 51299 were used.

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[8] 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.

[9] 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.

[10] 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.

[11] 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)[12]

CLSI Antimicrobial Class[13]	**Antimicrobial Agent**	**Breakpoints (µg/ml)**		
		Susceptible	**Intermediate**	**Resistant**
Aminoglycosides	Gentamicin	≤ 4	8	≥ 16
	Kanamycin	≤ 16	32	≥ 64
	Streptomycin[14]	≤ 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
Folate Pathway Inhibitors	Cephalothin	≤ 8	16	≥ 32
	Sulfonamides[15]	≤ 256	Not Applicable	≥ 512
	Trimethoprim–Sulfamethoxazole	≤ 2 / 38	Not Applicable	≥ 4 / 76
Macrolides	Azithromycin	≤ 16	Not Applicable	≥ 32
Penicillins	Ampicillin	≤ 8	16	≥ 32
Phenicols	Chloramphenicol	≤ 8	16	≥ 32
Quinolones	Ciprofloxacin *E. coli*	≤ 1	2	≥ 4
	Salmonella	≤ 0.06	0.12-0.5	≥ 1
	Nalidixic acid	≤ 16	Not Applicable	≥ 32
Tetracyclines	Tetracycline	≤ 4	8	≥ 16

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

Table 2. *Campylobacter* Interpretive Criteria (breakpoints)[16]

CLSI Antimicrobial Class[17]	**Antimicrobial Agent**	**Breakpoints (µg/ml) Etest (1998-2004)**			**Breakpoints (µg/ml) Broth Microdilution (2005-2011)**		
		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

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[16] 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.

[17] According to CLSI M100 document.

Table 3. *Enterococcus* Interpretive Criteria (breakpoints)[18]

CLSI Subclass[19]	Antimicrobial Agent	Breakpoints (µg/ml)		
		Susceptible	Intermediate	Resistant
Aminoglycoside[20]	Gentamicin	≤ 500	N/A	> 500
	Kanamycin	≤ 512	N/A	≥ 1024
	Streptomycin	≤ 1000	N/A	> 1000
Glycopeptide	Vancomycin	≤ 4	8 - 16	≥ 32
Glycylcycline	Tigecycline[21]	≤ 0.25	N/A	N/A[4]
Lincosamides	Lincomycin	≤ 2	4	≥ 8
Lipopeptide	Daptomycin[22]	≤ 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

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[18] 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.

[19] According to CLSI M100 document.

[20] For the aminoglycosides, breakpoints refer to high-level aminoglycoside resistance.

[21] 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.

[22] 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 .

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.

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 2011 for *Salmonella*, from 1998 through 2011 for *Campylobacter*, from 2000 through 2011 for *E. coli* and from 2003 through 2011 for *Enterococcus*.

MIC distributions are presented for 2011. 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.[23]

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), macrolides (azithromycin), 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 2005-2011), lincosamides (clindamycin), macrolides (azithromycin and erythromycin), phenicols (chloramphenicol 1998-2004 and florfenicol 2005-2011), 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 2006-2011), lincosamides (lincomycin), lipopeptides (daptomycin 2004-2011), macrolides (erythromycin and tylosin), nitrofurans (nitrofurantoin), oxazolidinones (linezolid), penicillins (penicillin), phenicols (chloramphenicol), phosphoglycolipid (flavomycin), quinolones (ciprofloxacin), streptogramins

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[23] 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.

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

IV. Data Analysis

A summary of results obtained from testing of 2011 isolates from food animals is included below. Although this does not include the determination of statistically significant changes when compared to previous years, it is meant to provide notable observations.

A. *Salmonella*

In addition to a brief review of serotype frequencies, resistance levels to critically important antimicrobials used in human medicine are reported. Quinolones, third generation cephalosporins and macrolides were identified to be either the sole therapy or one of a few alternatives to treat serious cases in humans. Additionally, these antimicrobial classes are used against organisms that may be transmitted from nonhuman sources. [24]

Serotype Frequencies

- Overall, Kentucky, Hadar, Montevideo and Adelaide ranked as the most prevalent serotype for chickens, turkeys, cattle and swine, respectively.
- 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%) through 2011 (46.2%). At the same time an increase in Heidelberg was observed from 2006 to 2008 before declining in 2009 (13.4%) and 2010 (4.4%). In 2011 however, Heidelberg slightly increased to 5.7%. Since 2002, recovery of Enteritidis has increased to 27.3% of isolates from chickens in 2011.
- Among isolates recovered from turkeys, Hadar remained below 18.5% through 2004, increased in 2007 to 43.5%, and has since declined to 19.4% in 2011. Since testing began, Schwarzengrund, Muenchen and antigenic formula III 18:z4, z23:- had the highest distributions in 2011 (9.7%, 8.7% and 12.6%, respectively).
- After a decrease in 2010, the recovery of Montevideo among cattle isolates increased to 29.1% in 2011. With the exception of 2005, Dublin has shown an upward trend from 2005 to 2010 (from 3.6% to 16.6%). In 2011, however, Dublin decreased to 11.2%. Recovery of Anatum and Kentucky has remained at, or below, 6.5% since 2005. In 2011, Muenster distributions increased to 7.1% which is a trend similar to what was observed in 2007 (7.7%).

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[24] Collingnon, P., Powers, J., Chiller, T., Aidara-Kane, A., and Aarestrup F. 2009. World Health Organization Ranking of Antimicrobials According to Their Importance in Human Medicine: A Critical Step for Developing Risk Management Strategies for the Use of Antimicrobials in Food Production Animals. Clinical Infectious Diseases, *49*(1):132-141.

- 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 was observed from 2009 (22.5%) through 2011 (11.2%). An increase in Adelaide was observed in 2011 (14.4%) and represents the highest percent recovered to date. Variations were noted for recovery of Anatum, Infantis and Johannesburg from 1997-2011, but overall remained at or below 13.5%.

Quinolones

- A breakpoint change for ciprofloxacin for invasive *Salmonella* was published in the 2012 CLSI M100 document and applied to isolates in this report.[25] A total of twelve isolates among all years were classified as ciprofloxacin resistant using the new lower breakpoint of ≥ 1 µg/ml (chickens n=4, turkeys n=5, and cattle n=3). Interestingly, ten of the ciprofloxacin resistant isolates were all distinct serotypes except for 2 isolates which were serotype Kentucky. In 2011, the 2 ciprofloxacin resistant isolates were Melagridis (n=1) and antigenic formula Rough O:g,p:- (n=1).

- In 2011, no resistance to nalidixic acid was detected for chickens, turkeys and swine. Among cattle, resistance to nalidixic acid decreased from 2.8% (n=7) in 2010 to 1.8% (n=6) in 2011. Nalidixic acid resistance observed among cattle was primarily attributed to serotype Dublin in both 2010 and 2011. The historical peaks of nalidixic acid resistance among turkey from 1999 to 2002 ranged from 5.1% to 5.3% and were credited to different serotypes including Hadar, Muenster, Typhimurium, and Saintpaul. However the frequency of these serotypes among turkey has also varied. While Muenster and Typhimurium isolate numbers have decreased, Hadar and Saintpaul continue to be identified and tested at similar rates; however, resistance to nalidixic acid among these serotypes has been rare.

Cephalosporins

- In 2011, resistance to ceftriaxone, a third-generation cephalosporin, remained highest among cattle isolates followed by turkeys and chickens (14.4%, 11.7% and 6.3% for cattle, turkeys and chickens, respectively). However, these numbers show a decrease from 2010. Among swine, ceftriaxone resistance remained low (2.2%, n=2). The major contributors of ceftriaxone resistance in 2011 were Dublin isolates from cattle (22.3%, n=21), Kentucky isolates from chickens (21.3%, n=20) and Newport isolates from cattle (10.6%, n=10).

Macrolides

- Azithromycin was first added to the NARMS panel in 2011 and is the only representative of the macrolides class. Only one *S*. Meleagridis isolate from cattle showed resistance to azithromycin while all isolates from chickens, turkeys and swine were susceptible to azithromycin.

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

Resistance Among Other Serotypes of Interest

- Enteritidis, one of the most common *Salmonella* serotypes identified in humans, was susceptible to amoxicillin/clavulanic acid and to the cephems class while exhibiting $\leq$ 3.3% resistance to all other antimicrobials tested.
- In 2011, Newport, while less frequent than in previous years, was still identified among the most common serotypes in cattle (n=14/340) and turkey (n=4/103). The majority of the isolates (n=11, 57.9%) showed resistance to at least amoxicillin/clauvulanic acid, ampicillin, cefoxitin, ceftiofur, ceftriaxone, chloramphenicol, streptomycin, suflisoxazole and tetracycline. Of the remaining isolates however, 6 were pan-susceptible and 2 were only resistant to tetracycline.
- A total of 51 Typhimurium isolates (including var. 5-), accounting for 5.0% of all isolates, were tested in 2011. This is the lowest number and percent of Typhimurium isolates observed since testing began in 1997. In 2011, 33.3% (n=17) of Typhimuriums were pan-suceptible, a single isolate (2.0%) was resistant to tetracycline only, 31.4% (n=16) were resistant to exactly sulfisoxazole and tetracycline, while an additional 33.3% (n=17) presented various resistance profiles to ≥ 3 antimicrobial classes. A single isolate was confirmed as Definitive Type (DT) 104, from a total of 8 DT104 suspects which presented resistance to at least ampicillin, chloramphenicol, streptomycin, sulfizoxazole and tetracycline (ACSSuT).

Multiple Drug Resistance

- In 2011, resistance to ≥ 3 antimicrobial classes declined among all animal sources to 7.9% in chickens, 24.5% in turkeys, 20.0% in cattle and 15.6% in swine. Additionally, these were the lowest MDR levels observed among chicken and swine isolates since testing began in 1997, among cattle isolates since 2001 and among turkey isolates since 2002.
- In 2011, resistance to at least ACSSuT among all serotypes was the lowest observed since 2000, 0.4% (n=2) in chickens, 1.0% (n=1) in turkeys, 12.6% (n=43) in cattle and 4.4% (n=4) in swine.
- Similarly, resistance to the profile ACSSuT with additional resistance to amoxicillin/clavulanic acid and ceftriaxone (ACSSuTAuCx) was 0.4% (n=2) in chickens, 1.0% (n=1) in turkeys, 11.2% (n=38) in cattle and 2.2% (n=2) in swine. The majority of the isolates contributing to this pattern were serotype Dublin (n=12), Newport, (n=10), Typhimurium (including var. 5-, n=5) and Montevideo (n=4).

B. *Campylobacter*

Species Frequencies

- Despite changes in sampling schemes and isolation methods, the distribution of *Campylobacter* species recovered from chicken has remained stable since testing began. *Campylobacter jejuni* was more frequently recovered than *C. coli* for all report years.

Antimicrobial Resistance

- No resistance to florfenicol was observed for either species. Likewise, no *C. coli* isolates and only 1 *C. jejuni* isolate were resistant to clindamicin.

- In 2011, *C. jejuni* resistance to nalidixic acid and ciprofloxacin was the same (19.2%) while *C. coli* resistance to nalidixic acid (27.5%) and ciprofloxacin (27.9%) differed only slightly.

- Macrolide resistance continued to decrease in *C. coli* (4.0 to 3.4%) while in *C. jejuni* resistance increased slightly (0.0 to 0.6%).

- Although the number of *C. coli* isolates resistant to gentamicin from 2010 to 2011 doubled from 5 to 13, the overall percentage change was less than 1%. Only 1 *C. jejuni* isolate was gentamicin resistant in 2010 and 2011.

- In 2011, ciprofloxacin resistance was the highest ever reported for *C. coli* (27.9%) but decreased for *C. jejuni* (23.1 to 19.2%).

- Tetracycline resistance in *C. coli* increased from 2009 (44.4%) to 2010 (56.0%) but decreased in 2011 (42.1%); in *C. jejuni,* however, resistance to tetracycline has generally remained stable.

- Overall, MDR has been more frequently observed in *C. coli* than *C. jejuni.*

C. *Escherichia coli* (generic)

Antimicrobial Resistance

- In 2011, only 2 isolates (0.3%) were resistant to ciprofloxacin. Since 1997, ciprofloxacin resistance has remained below 0.6% (n=6) which was observed in 2008.

- Nalidixic acid resistance declined from 3.4% (n=32) in 2010 to 2.3% (n=14) in 2011 which has been the lowest percentage observed since 1997.

- Resistance to the cephalosporins class decreased in 2011 from 12.5% to 9.1% for cefoxitin, 12.3% to 9.3% for ceftriaxone and from 10.0% to 6.8% to ceftiofur. These results continue the overall decline in resistance to the cephems class since its peak in 2006. Additionally, these resistance levels are similar to those observed in 2005.

- A single *E. coli* isolate was resistant to azithromyzin (0.2%) in 2011.

- The highest resistance observed was to sulfisoxazole (54.7%), streptomycin (50.8%), gentamicin (49.0%) and tetracycline (46.6%) all of which also showed an increase from 2010 levels.

- Resistance to ≥ 3 antimicrobial classes slightly increased from 38.3% (n=360) in 2010 to 39.6% (n=243) in 2011. The percent resistance to ≥ 4 and ≥ 5 classes decreased while the percent pan-susceptible isolates, as well as those resistant to ≥ 1 and ≥ 2 classes remained stable as observed since 2008.

C. *Enterococcus*

Species Frequencies

- The most frequent species identified from chickens in 2011 were *E. faecalis* (52.5%, n=275), *E. faecium* (24.4%, n=128), *E. hirae* (7.4%, n=39), *E. durans* (5.0%, n=26), and *E. casseliflavus* (3.8%, n=20).

Antimicrobial Resistance

- No resistance was observed to vancomycin or linezolid from 2003 through 2011, while resistance to tigecycline, daptomycin and chloramphenicol remained below 1.0% for all years.

- Resistance to ciprofloxacin (12.6%), quinupristin/dalfopristin (47.4%) and tetracycline (75.6%) increased in 2011 and were the highest levels observed since testing began.

- Resistance to various antimicrobials was quite distinct between *E. faecalis* and *E. faecium*. Resistance to nitrofurantoin, penicillin and ciprofloxacin was $\geq$ 24.2% for *E. faecium* while resistance to these drugs was ≤ 3.3% for *E. faecalis*. Conversely, resistance to gentamicin, kanamycin, erythromycin and tylosin was higher among *E. faecalis* (≥ 36.7%) than *E. faecium* (≤ 24.2%).

- Following an increase in resistance from 2009 to 2010, nitrofurantoin and penicillin resistance decreased in 2011 (from 23.0% to 18.7% and from 9.3% to 7.4%, respectively). At the species level, resistance to both of these antimicrobials was more common among *E. faecium* and *E. durans*.

- In 2011, MDR ($\geq$ 3, $\geq$ 4 and $\geq$ 5 antimicrobial classes) in *E. faecium* was higher than *E. faecalis* and is consistent with the trend that has been observed since 2007.

Mention of trade names or commercial products is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.

V. NARMS Animal Arm Contacts

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VI. Results

A. *Salmonella*

Table 1A. Number of *Salmonella* Isolates Tested by Year and Animal Source, 1997-2011

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**	**2011 n=1024**
Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	564	491
Turkeys	107	240	713	518	550	244	262	236	227	304	271	148	121	151	103
Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443	200	247	340
Swine	111	793	876	451	418	379	211	308	301	304	211	111	120	111	90

Table 2A. Most Common Serotypes among *Salmonella* Isolates Tested, 2011

Animal Source	Rank	Serotype	n	%
Chickens (n=491)	1	Kentucky	227	46.2
	2	Enteritidis	134	27.3
	3	Heidelberg	28	5.7
	4	Typhimurium var. 5-	19	3.9
	5	Infantis	16	3.3
	6	Typhimurium	11	2.2
	7	Mbandaka	7	1.4
	7	Braenderup	7	1.4
	8	Johannesburg	6	1.2
	9	I 4,[5],12:i:-	6	1.2
	9	I 8,20:-:z6	5	1.0
Subtotal			466	94.9
		Others	25	5.1
Total			491	100

Animal Source	Rank	Serotype	n	%
Turkeys (n=103)	1	Hadar	20	19.4
	2	IIIa 18:z4,z23:-	13	12.6
	3	Schwarzengrund	10	9.7
	4	Muenchen	9	8.7
	5	Saintpaul	6	5.8
	6	Heidelberg	5	4.9
	6	Berta	5	4.9
	7	Newport	4	3.9
	7	Reading	4	3.9
	7	Albany	4	3.9
	8	Agona	3	2.9
Subtotal			83	80.6
		Others	20	19.4
Total			103	100

Animal Source	Rank	Serotype	n	%
Cattle (n=340)	1	Montevideo	99	29.1
	2	Dublin	38	11.2
	3	Muenster	24	7.1
	4	Kentucky	18	5.3
	5	Anatum	17	5.0
	6	Infantis	15	4.4
	7	Cerro	14	4.1
	7	Meleagridis	14	4.1
	8	Newport	13	3.8
	9	Typhimurium	11	3.2
Subtotal			263	77.4
		Others	77	22.6
Total			340	100

Animal Source	Rank	Serotype	n	%
Swine (n=90)	1	Adelaide	13	14.4
	2	Johannesburg	12	13.3
	3	Derby	10	11.1
	3	Infantis	10	11.1
	4	Anatum	8	8.9
	5	Agona	5	5.6
	6	Ohio	4	4.4
	7	Uganda	3	3.3
	7	Typhimurium var. 5-	3	3.3
Subtotal			68	75.6
		Others	22	24.4
Total			90	100

Figure 1A. Chickens- Serotype Percent Distribution by Year in Relation to Top Serotypes Identified in 2011

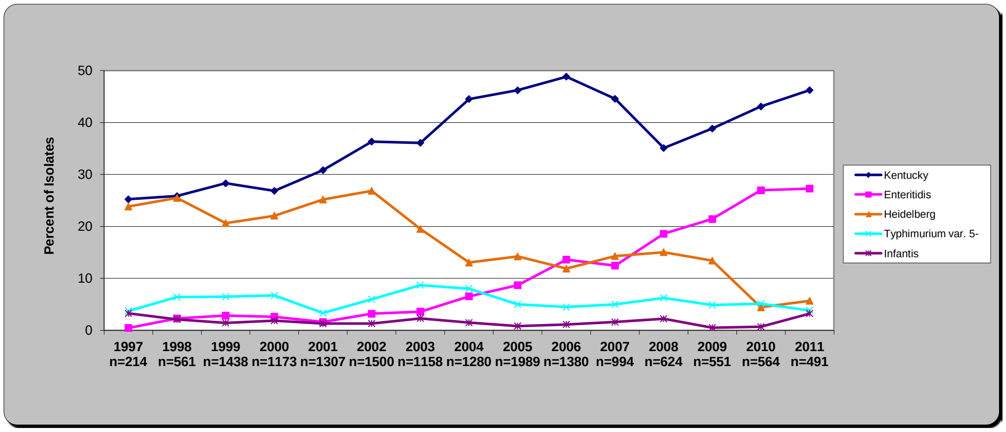
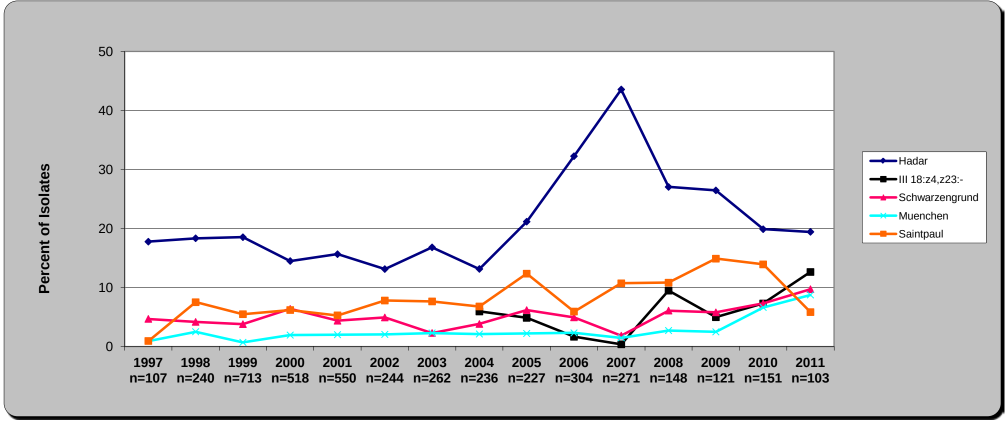


Figure 2A. Turkeys- Serotype Percent Distribution by Year in Relation to Top Serotypes Identified in 2011[1]



[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 2011

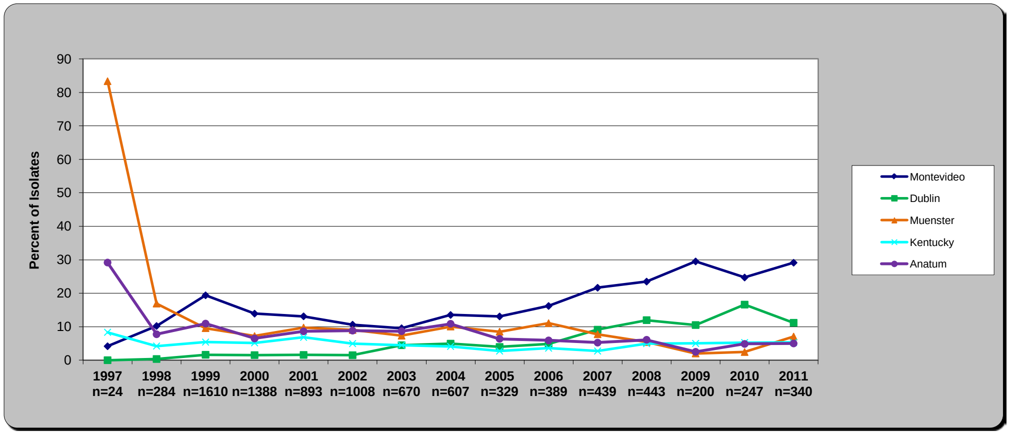


Figure 4A. Swine- Serotype Percent Distribution by Year in Relation to Top Serotypes Identified in 2011

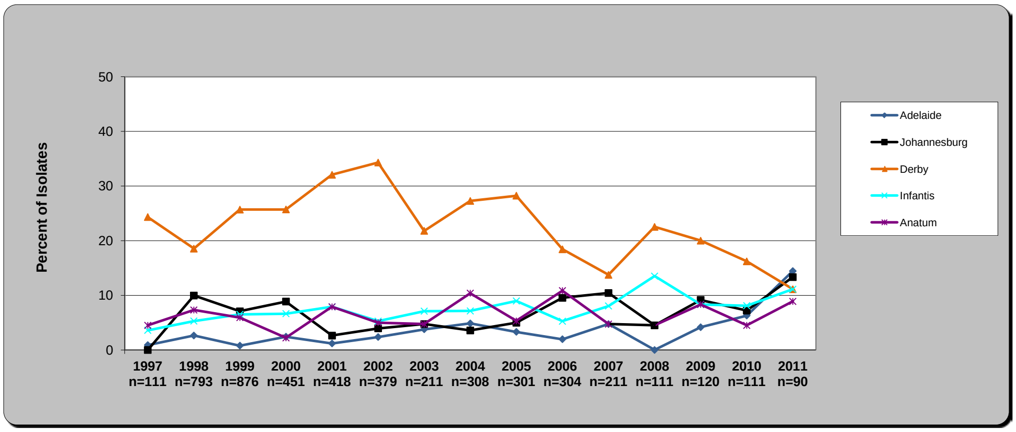


Table 3A. Distribution of MICs and Occurrence of Resistance by Animal Source among *Salmonella* , 2011

Antimicrobial	Isolate Source (# of Isolates)	%I[1]	%R[2]	95% CI[3]	Distribution (%) of MICs (µg/ml)[4] 0.015	0.03	0.06	0.125	0.25	0.50	1	2	4	8	16	32	64	128	256	512	1024
Aminoglycosides																					
Gentamicin	Chickens (491)	0.4	**3.5**	2.4-6.1					60.5	34.4	1.2			0.4	**1.4**	**2.0**					
	Turkeys (103)	1.9	**14.6**	10.2-25.4					44.7	35.9	1.9	1.0		1.9	**4.9**	**9.7**					
	Cattle (340)	0.3	**2.1**	1.1-4.8					37.1	56.2	3.8	0.3	0.3	0.3		**2.1**					
	Swine (90)	0.0	**0.0**	0.0-5.1					78.9	21.1											
Kanamycin	Chickens (491)	0.4	**0.6**	0.2-1.9										98.6	0.4	0.4		**0.6**			
	Turkeys (103)	1.9	**8.7**	4.3-16.3										89.3		1.9	**1.9**	**6.8**			
	Cattle (340)	0.0	**6.2**	4.0-9.5										93.2	0.6		**0.6**	**5.6**			
	Swine (90)	0.0	**3.3**	0.8-10.1										96.7				**3.3**			
Streptomycin	Chickens (491)	N/A	**35.8**	31.6-40.2												64.2	**27.9**	**7.9**			
	Turkeys (103)	N/A	**22.3**	14.9-31.8												77.7	**14.6**	**7.8**			
	Cattle (340)	N/A	**19.4**	15.4-24.1												80.6	**2.1**	**17.4**			
	Swine (90)	N/A	**18.9**	11.7-28.8												81.1	**6.7**	**12.2**			
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Chickens (491)	0.2	**6.3**	4.4-8.9							90.2	2.9		0.4	0.2	**1.8**	**4.5**				
	Turkeys (103)	6.8	**11.7**	6.5-19.9							72.8		1.0	7.8	6.8	**3.9**	**7.8**				
	Cattle (340)	1.2	**14.7**	11.2-19.0							80.0	2.1	1.5	0.6	1.2	**3.8**	**10.9**				
	Swine (90)	1.1	**2.2**	0.4-8.5							88.9		5.6	2.2	1.1	**1.1**	**1.1**				
Cephems																					
Cefoxitin	Chickens (491)	0.2	**6.5**	4.6-9.2						0.2	17.7	61.1	13.6	0.6	0.2	**5.5**	**1.0**				
	Turkeys (103)	0.0	**11.7**	6.5-19.9							8.7	58.3	18.4	2.9		**2.9**	**8.7**				
	Cattle (340)	1.2	**13.8**	10.4-18.0							7.4	39.4	35.3	2.9	1.2	**5.0**	**8.8**				
	Swine (90)	0.0	**2.2**	0.4-8.5							1.1	35.6	56.7	4.4			**2.2**				
Ceftiofur	Chickens (491)	0.4	**6.1**	4.2-8.7				0.4	1.0	43.0	47.9	1.2	0.4		**6.1**						
	Turkeys (103)	0.0	**11.7**	6.5-19.9						44.7	42.7	1.0			**11.7**						
	Cattle (340)	1.8	**13.2**	9.9-17.4					0.6	34.7	48.8	0.9	1.8	**1.5**	**11.8**						
	Swine (90)	0.0	**2.2**	0.4-8.5						30.0	66.7	1.1			**2.2**						
Ceftriaxone	Chickens (491)	0.0	**6.3**	4.4-8.9					93.1	0.6			**0.2**	**0.6**	**4.9**	**0.2**	**0.4**				
	Turkeys (103)	0.0	**11.7**	6.5-19.9					88.3					**1.0**	**2.9**	**3.9**	**3.9**				
	Cattle (340)	0.3	**14.4**	10.9-18.7					85.0	0.3		0.3	**1.2**	**2.6**	**4.7**	**5.0**	**0.6**	**0.3**			
	Swine (90)	0.0	**2.2**	0.4-8.5					97.8						**1.1**	**1.1**					

[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 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* , 2011

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 (491)	N/A	**7.9**	5.7-10.7											12.8	58.7	20.2	0.4		**7.9**	
	Turkeys (103)	N/A	**22.3**	14.9-31.8											21.4	46.6	9.7			**22.3**	
	Cattle (340)	N/A	**20.0**	16.0-24.7											11.8	46.8	20.3	0.9	0.3	**20.0**	
	Swine (90)	N/A	**17.8**	10.8-27.6											36.7	28.9	14.4	2.2		**17.8**	
Trimethoprim-Sulfamethoxazole	Chickens (491)	N/A	**0.2**	0-1.3				99.6	0.2					**0.2**							
	Turkeys (103)	N/A	**0.0**	0.0-4.5				99.0	1.0												
	Cattle (340)	N/A	**1.8**	0.7-4.0				86.5	9.4	2.4			**0.3**	**1.5**							
	Swine (90)	N/A	**0.0**	0.0-5.1				95.6	4.4												
Macrolides																					
Azithromycin	Chickens (491)	75.4	**0.0**	0.0-1.0				0.2			0.8	16.1	75.4	7.5							
	Turkeys (103)	73.8	**0.0**	0.0-4.5								17.5	73.8	8.7							
	Cattle (340)	81.5	**0.3**	0.0-1.9						0.3		4.1	81.5	13.2	0.6	**0.3**					
	Swine (90)	75.6	**0.0**	0.0-5.1									75.6	23.3	1.1						
Penicillins																					
Ampicillin	Chickens (491)	0.0	**7.3**	5.2-10.1							89.6	2.6	0.2	0.2		**0.2**	**7.1**				
	Turkeys (103)	0.0	**27.2**	19.1-37.0							71.8	1.0					**27.2**				
	Cattle (340)	0.0	**17.1**	13.3-21.6							79.4	2.1	1.2	0.3			**17.1**				
	Swine (90)	0.0	**11.1**	5.7-19.9							85.6	3.3					**11.1**				
Phenicols																					
Chloramphenicol	Chickens (491)	0.4	**0.4**	0.1-1.6								10.2	62.7	26.3	0.4	**0.2**	**0.2**				
	Turkeys (103)	0.0	**1.0**	0.1-6.1								5.8	64.1	29.1			**1.0**				
	Cattle (340)	0.0	**17.9**	14.1-22.5								0.3	44.4	37.4		**0.6**	**17.4**				
	Swine (90)	2.2	**4.4**	1.4-11.6									28.9	64.4	2.2		**4.4**				
Quinolones																					
Ciprofloxacin	Chickens (491)	0.0	**0.0**	0.0-1.0	91.4	8.6															
	Turkeys (103)	0.0	**0.0**	0.0-4.5	97.1	2.9															
	Cattle (340)	1.8	**0.6**	0.1-2.4	92.1	5.0	0.6	0.6	0.6	0.6	**0.3**			**0.3**							
	Swine (90)	0.0	**0.0**	0.0-5.1	95.6	4.4															
Nalidixic Acid	Chickens (491)	N/A	**0.0**	0.0-1.0						0.4	3.5	62.3	33.6	0.2							
	Turkeys (103)	N/A	**0.0**	0.0-4.5							1.9	71.8	26.2								
	Cattle (340)	N/A	**1.8**	0.7-4.0								62.6	34.1	0.9	0.6	**0.3**	**1.5**				
	Swine (90)	N/A	**0.0**	0.0-5.1								61.1	38.9								
Tetracyclines																					
Tetracycline	Chickens (491)	0.4	**40.9**	36.5-45.4									58.7	0.4		**1.2**	**39.7**				
	Turkeys (103)	0.0	**45.6**	35.9-55.7									54.4				**45.6**				
	Cattle (340)	0.3	**30.6**	25.8-35.8									69.1	0.3	**0.9**	**2.9**	**26.8**				
	Swine (90)	0.0	**41.1**	31.0-52.0									58.9		**1.1**	**3.3**	**36.7**				

[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, 1997-2011

Year			**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Number of Isolates Tested		Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	546	491
		Turkeys	107	240	713	518	550	244	262	236	227	304	271	148	121	151	103
		Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443	200	247	340
		Swine	111	793	876	451	418	379	211	308	301	304	211	111	120	111	90
Antimicrobial Class	**Antimicrobial**	**Isolate Source**															
Aminoglycosides	Gentamicin	Chickens	17.8% 38	15.3% 86	10.4% 150	14.9% 175	7.9% 103	5.5% 83	6.3% 73	4.9% 63	4.3% 85	5.7% 79	4.5% 45	5.6% 35	5.6% 31	4.6% 26	3.5% 17
		Turkeys	20.6% 22	18.3% 44	17.5% 125	16.2% 84	20.9% 115	19.3% 47	21.0% 55	25.4% 60	22.9% 52	16.4% 50	12.9% 35	16.9% 25	14.9% 18	19.9% 30	14.6% 15
		Cattle	0.0% 0	1.8% 5	1.6% 25	2.1% 29	2.1% 19	2.6% 26	2.7% 18	1.8% 11	2.4% 8	3.9% 15	1.6% 7	1.6% 7	2.0% 4	4.9% 12	2.1% 7
		Swine	0.9% 1	0.8% 6	1.1% 10	1.3% 6	1.4% 6	0.8% 3	0.5% 1	1.3% 4	2.7% 8	2.0% 6	0.9% 2	2.7% 3	0.0% 0	2.7% 3	0.0% 0
	Kanamycin	Chickens	2.3% 5	3.2% 18	1.2% 17	4.1% 48	2.4% 31	2.0% 30	2.8% 32	2.7% 34	2.5% 49	3.6% 49	3.4% 34	3.4% 21	3.1% 17	4.3% 24	0.6% 3
		Turkeys	24.3% 26	17.1% 41	21.5% 153	21.4% 111	22.9% 126	24.2% 59	16.0% 42	14.4% 34	19.8% 45	10.5% 32	16.2% 44	14.2% 21	10.7% 13	19.2% 29	8.7% 9
		Cattle	8.3% 2	9.5% 27	7.1% 115	6.6% 92	6.9% 62	10.1% 102	13.7% 92	8.9% 54	13.1% 43	9.5% 37	7.7% 34	9.9% 44	9.0% 18	12.6% 31	6.2% 21
		Swine	11.7% 13	7.2% 57	6.7% 59	9.3% 42	6.9% 29	4.2% 16	5.7% 12	3.9% 12	5.0% 15	8.6% 26	7.1% 15	3.6% 4	4.2% 5	10.8% 12	3.3% 3
	Streptomycin	Chickens	24.3% 52	27.8% 156	27.5% 396	28.6% 335	21.0% 275	22.9% 343	19.6% 227	22.2% 284	23.3% 464	21.2% 293	19.3% 192	25.2% 157	30.5% 168	36.0% 203	35.8% 176
		Turkeys	34.6% 37	40.8% 98	43.6% 311	41.9% 217	46.7% 257	37.7% 92	29.4% 77	33.9% 80	40.1% 91	28.9% 88	34.7% 94	32.4% 48	38.8% 47	27.8% 42	22.3% 23
		Cattle	12.5% 3	16.2% 46	15.4% 248	21.3% 296	20.3% 181	25.9% 261	28.7% 192	20.9% 127	24.3% 80	23.7% 92	19.8% 87	23.0% 102	22.0% 44	26.7% 66	19.4% 66
		Swine	27.9% 31	29.4% 233	29.3% 257	39.2% 177	35.6% 149	40.1% 152	30.8% 65	36.4% 112	36.5% 110	26.3% 80	27.0% 57	29.7% 33	29.2% 35	31.5% 35	18.9% 17
β-Lactam/β-Lactamase Inhibitor Combinations	Amoxicillin-Clavulanic Acid	Chickens	0.5% 1	2.0% 11	4.9% 70	7.3% 86	4.5% 59	10.2% 153	9.7% 112	12.4% 159	12.1% 241	12.9% 178	15.6% 155	8.7% 54	12.9% 71	11.7% 66	6.3% 31
		Turkeys	4.7% 5	0.4% 1	4.3% 31	3.5% 18	6.9% 38	3.7% 9	1.5% 4	4.7% 11	3.5% 8	5.6% 17	11.1% 30	5.4% 8	13.2% 16	15.2% 23	11.7% 12
		Cattle	8.3% 2	2.5% 7	3.9% 62	9.9% 138	11.8% 105	17.7% 178	21.0% 141	13.5% 82	21.0% 69	18.5% 72	15.5% 68	16.5% 73	15.0% 30	21.5% 53	14.7% 50
		Swine	0.0% 0	0.4% 3	1.0% 9	1.8% 8	2.6% 11	3.7% 14	3.8% 8	1.9% 6	4.3% 13	2.3% 7	3.3% 7	4.5% 5	4.2% 5	3.6% 4	2.2% 2

Table 4A (continued). Antimicrobial resistance among *Salmonella* by Animal Source, 1997-2011

Year			1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of Isolates Tested		Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	546	491
		Turkeys	107	240	713	518	550	244	262	236	227	304	271	148	121	151	103
		Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443	200	247	340
		Swine	111	793	876	451	418	379	211	308	301	304	211	111	120	111	90
Antimicrobial Class	**Antimicrobial**	**Isolate Source**															
Cephems	Cefoxitin	Chickens	Not Tested	Not Tested	Not Tested	7.2% 85	4.1% 53	8.7% 130	8.2% 95	12.4% 159	12.0% 238	12.8% 176	13.0% 129	8.0% 50	11.4% 63	11.3% 64	6.5% 32
		Turkeys	Not Tested	Not Tested	Not Tested	3.3% 17	4.5% 25	2.5% 6	1.1% 3	5.1% 12	3.5% 8	5.3% 16	9.2% 25	5.4% 8	12.4% 15	15.2% 23	11.7% 12
		Cattle	Not Tested	Not Tested	Not Tested	9.1% 126	11.1% 99	15.9% 160	17.8% 119	13.2% 80	19.8% 65	17.7% 69	15.0% 66	14.7% 65	13.5% 27	20.6% 51	13.8% 47
		Swine	Not Tested	Not Tested	Not Tested	1.3% 6	2.2% 9	2.9% 11	4.3% 9	1.9% 6	3.7% 11	2.0% 6	2.8% 6	4.5% 5	4.2% 5	1.8% 2	2.2% 2
	Ceftiofur	Chickens	0.5% 1	2.0% 11	5.2% 75	7.6% 89	4.1% 54	10.2% 153	9.8% 113	12.4% 159	12.2% 242	12.8% 177	15.4% 153	8.7% 54	12.7% 70	12.1% 68	6.1% 30
		Turkeys	3.7% 4	0.4% 1	4.6% 33	3.3% 17	5.1% 28	3.3% 8	1.5% 4	4.7% 11	3.5% 8	5.3% 16	11.1% 30	5.4% 8	12.4% 15	15.2% 23	11.7% 12
		Cattle	0.0% 0	2.1% 6	4.2% 67	9.8% 136	11.4% 102	17.4% 175	21.0% 141	13.3% 81	21.6% 71	18.8% 73	15.5% 68	16.3% 72	14.5% 29	21.5% 53	13.2% 45
		Swine	0.0% 0	0.1% 1	1.9% 17	1.3% 6	2.2% 9	3.2% 12	4.3% 9	1.9% 6	3.7% 11	2.0% 6	2.8% 6	4.5% 5	4.2% 5	1.8% 2	2.2% 2
	Ceftriaxone	Chickens	0.5% 1	1.8% 10	4.6% 66	7.4% 87	4.1% 54	9.9% 149	9.7% 112	12.3% 158	12.2% 242	12.8% 177	15.6% 155	8.7% 54	12.9% 71	11.9% 67	6.3% 31
		Turkeys	3.7% 4	0.4% 1	4.2% 30	3.1% 16	4.7% 26	3.3% 8	1.1% 3	4.7% 11	3.5% 8	5.3% 16	11.1% 30	5.4% 8	12.4% 15	15.2% 23	11.7% 12
		Cattle	0.0% 0	2.1% 6	3.9% 63	9.9% 137	11.3% 101	17.3% 174	21.0% 141	13.5% 82	20.7% 68	18.5% 72	15.9% 70	16.0% 71	14.5% 29	21.5% 53	14.4% 49
		Swine	0.0% 0	0.1% 1	1.3% 11	1.3% 6	2.2% 9	2.9% 11	4.3% 9	1.6% 5	3.7% 11	1.6% 5	2.4% 5	4.5% 5	4.2% 5	1.8% 2	2.2% 2
	Cephalothin	Chickens	1.4% 3	4.5% 25	5.8% 83	7.8% 91	4.7% 62	10.5% 158	10.4% 121	10.4% 121	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
		Turkeys	5.6% 6	5.0% 12	10.5% 75	8.3% 43	13.1% 72	9.8% 24	11.1% 29	11.1% 29	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
		Cattle	0.0% 0	2.1% 6	4.7% 76	9.9% 137	11.6% 104	17.7% 178	21.2% 142	21.2% 142	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
		Swine	0.0% 0	0.1% 1	0.8% 7	2.4% 11	2.2% 9	3.2% 12	3.8% 8	3.8% 8	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
Folate Pathway Inhibitors	Sulfonamides[1]	Chickens	24.8% 53	23.7% 133	15.9% 229	18.4% 216	11.8% 154	8.9% 133	10.3% 119	11.9% 152	8.5% 169	10.7% 148	10.4% 103	13.3% 83	10.0% 55	12.4% 70	7.9% 39
		Turkeys	37.4% 40	32.1% 77	36.0% 257	25.1% 130	38.0% 209	30.3% 74	28.2% 74	36.4% 86	37.0% 84	27.3% 83	25.5% 69	24.3% 36	28.9% 35	25.2% 38	22.3% 23
		Cattle	20.8% 5	15.5% 44	15.0% 242	19.9% 276	19.7% 176	22.3% 225	25.1% 168	22.7% 138	27.4% 90	24.2% 94	21.6% 95	24.8% 110	24.5% 49	26.3% 65	20.0% 68
		Swine	34.2% 38	29.0% 230	30.7% 269	35.7% 161	34.9% 146	34.6% 131	25.1% 53	37.0% 114	32.9% 99	26.6% 81	30.8% 65	31.5% 35	30.8% 37	28.8% 32	17.8% 16
	Trimethoprim-Sulfamethoxazole	Chickens	0.5% 1	1.2% 7	1.1% 16	0.4% 5	0.5% 6	0.8% 12	0.3% 4	0.2% 3	0.2% 4	0.1% 1	0.0% 0	0.3% 2	0.2% 1	0.0% 0	0.2% 1
		Turkeys	3.7% 4	2.5% 6	4.2% 30	1.5% 8	2.5% 14	2.5% 6	2.3% 6	0.8% 2	1.8% 4	1.0% 3	1.1% 3	1.4% 2	1.7% 2	0.0% 0	0.0% 0
		Cattle	4.2% 1	2.5% 7	2.4% 39	2.2% 30	2.6% 23	2.5% 25	3.3% 22	1.5% 9	4.9% 16	4.6% 18	3.0% 13	4.5% 20	1.5% 3	4.5% 11	1.8% 6
		Swine	1.8% 2	0.3% 2	1.1% 10	0.9% 4	0.0% 0	1.6% 6	2.4% 5	1.6% 5	2.3% 7	2.0% 6	1.9% 4	2.7% 3	2.5% 3	1.8% 2	0.0% 0

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

Table 4A (continued). Antimicrobial resistance among *Salmonella* by Animal Source, 1997-2011

Year			1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of Isolates Tested		Chickens	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	546	491
		Turkeys	107	240	713	518	550	244	262	236	227	304	271	148	121	151	103
		Cattle	24	284	1610	1388	893	1008	670	607	329	389	439	443	200	247	340
		Swine	111	793	876	451	418	379	211	308	301	304	211	111	120	111	90
Antimicrobial Class	**Antimicrobial**	**Isolate Source**															
Macrolides	Azithromycin	Chickens	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	0.0% 0
		Turkeys	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	0.0% 0
		Cattle	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	0.3% 1
		Swine	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	0.0% 0
Penicillins	Ampicillin	Chickens	11.7% 25	12.8% 72	12.4% 179	13.0% 152	9.4% 123	14.3% 215	13.7% 159	14.5% 185	14.0% 279	14.9% 205	17.0% 169	10.6% 66	13.8% 76	13.7% 77	7.3% 36
		Turkeys	12.1% 13	10.4% 25	17.7% 126	16.2% 84	19.5% 107	18.0% 44	18.7% 49	22.0% 52	22.9% 52	25.3% 77	36.9% 100	32.4% 48	38.8% 47	44.4% 67	27.2% 28
		Cattle	12.5% 3	9.2% 26	12.5% 202	18.7% 259	17.9% 160	23.9% 241	28.1% 188	19.3% 117	26.7% 88	22.4% 87	20.0% 88	21.7% 96	22.5% 45	26.3% 65	17.1% 58
		Swine	16.2% 18	12.9% 102	10.8% 95	18.8% 85	11.7% 49	13.7% 52	12.8% 27	16.2% 50	13.6% 41	11.5% 35	18.0% 38	14.4% 16	19.2% 23	17.1% 19	11.1% 10
Phenicols	Chloramphenicol	Chickens	2.3% 5	2.9% 16	1.8% 26	4.6% 54	2.5% 33	2.4% 36	2.1% 24	1.3% 16	1.8% 36	1.7% 24	1.8% 18	1.8% 11	1.6% 9	3.0% 17	0.4% 2
		Turkeys	3.7% 4	0.8% 2	4.1% 29	4.1% 21	3.8% 21	5.3% 13	4.2% 11	4.7% 11	4.8% 11	3.9% 12	5.5% 15	2.7% 4	3.3% 4	4.6% 7	1.0% 1
		Cattle	4.2% 1	5.6% 16	8.5% 137	15.1% 209	16.5% 147	20.6% 208	25.1% 168	17.6% 107	21.9% 72	19.8% 77	20.0% 88	19.6% 87	21.0% 42	25.1% 62	17.9% 61
		Swine	11.7% 13	8.4% 67	8.0% 70	12.4% 56	7.7% 32	10.0% 38	8.5% 18	12.7% 39	10.6% 32	7.9% 24	15.2% 32	9.9% 11	15.0% 18	8.1% 9	4.4% 4
Quinolones	Ciprofloxacin	Chickens	0.0% 0	0.2% 1	0.1% 1	0.0% 0	0.0% 0	0.7% 1	0.1% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys	0.0% 0	0.4% 1	0.0% 0	0.4% 2	0.2% 1	0.4% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		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	0.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.6% 2
		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	0.0% 0
	Nalidixic Acid	Chickens	0.0% 0	0.2% 1	0.2% 3	0.5% 6	0.0% 0	0.8% 12	0.4% 5	0.5% 6	0.3% 6	0.1% 2	0.1% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0
		Turkeys	4.7% 5	2.1% 5	5.3% 38	5.4% 28	5.1% 28	5.3% 13	3.8% 10	2.1% 5	2.2% 5	0.7% 2	1.1% 3	0.7% 1	0.8% 1	0.7% 1	0.0% 0
		Cattle	0.0% 0	0.4% 1	0.1% 1	0.4% 6	0.4% 4	0.4% 4	0.4% 3	2.0% 12	1.5% 5	0.5% 2	0.7% 3	0.7% 3	1.0% 2	2.8% 7	1.8% 6
		Swine	0.0% 0	0.0% 0	0.0% 0	0.2% 1	0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
Tetracyclines	Tetracycline	Chickens	20.6% 44	20.5% 115	25.0% 359	26.3% 308	21.9% 286	24.9% 374	26.2% 303	27.4% 351	28.3% 563	31.8% 439	35.5% 353	30.4% 190	33.9% 187	41.8% 236	40.9% 201
		Turkeys	52.3% 56	45.8% 110	52.9% 377	56.2% 291	54.9% 302	54.5% 133	58.8% 154	48.3% 114	54.6% 124	61.8% 188	73.8% 200	64.2% 95	63.6% 77	57.6% 87	45.6% 47
		Cattle	25.0% 6	24.3% 69	20.9% 336	25.8% 358	26.3% 235	32.0% 323	36.9% 247	31.8% 193	34.0% 112	30.3% 118	27.3% 120	29.3% 130	29.0% 58	33.6% 83	30.6% 104
		Swine	52.3% 58	47.5% 377	48.4% 424	54.3% 245	53.1% 222	57.8% 219	43.1% 91	58.8% 181	54.8% 165	62.8% 191	54.5% 115	51.4% 57	53.3% 64	51.4% 57	41.1% 37

Table 5A. Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Chickens, 2011[1]

	Serotype				Distribution (%) of MICs (µg/ml)[5]																
Antimicrobial	**(# 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**
Aminoglycosides																					
Gentamicin	Kentucky (227)	0.0	**1.3**	0.3-4.1					58.1	39.2	1.3				**0.9**	**0.4**					
	Enteritidis (134)	0.0	**0.0**	0.0-3.5					83.6	15.7	0.7										
	Heidelberg (28)	3.6	**14.3**	6.8-37.6					25.0	53.6	3.6			3.6	**7.1**	**7.1**					
	Typhimurium var. 5- (19)	0.0	**10.5**	1.8-34.5					73.7	15.8					**5.3**	**5.3**					
	Infantis (16)	0.0	**0.0**	0.0-24.1					62.5	37.5											
	Typhimurium (11)	0.0	**0.0**	0.0-32.1					63.6	36.4											
Kanamycin	Kentucky (227)	0.0	**0.0**	0.0-2.1										100.0							
	Enteritidis (134)	0.0	**0.0**	0.0-3.5										100.0							
	Heidelberg (28)	7.1	**7.1**	1.2-24.9										85.7		7.1		**7.1**			
	Typhimurium var. 5- (19)	0.0	**0.0**	0.0-20.9										100.0							
	Infantis (16)	0.0	**0.0**	0.0-24.1										100.0							
	Typhimurium (11)	0.0	**0.0**	0.0-32.1										100.0							
Streptomycin	Kentucky (227)	0.0	**69.2**	62.7-75.0												30.8	**55.9**	**13.2**			
	Enteritidis (134)	0.0	**0.0**	0.0-3.5												100.0					
	Heidelberg (28)	0.0	**14.3**	4.7-33.6												85.7	**3.6**	**10.7**			
	Typhimurium var. 5- (19)	0.0	**10.5**	1.8-34.5												89.5	**5.3**	**5.3**			
	Infantis (16)	0.0	**0.0**	0.0-24.1												100.0					
	Typhimurium (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 were established by NARMS.

Table 5A (continued). Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Chickens, 2011[1]

					Distribution (%) of MICs (µg/ml)[5]																
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**
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Kentucky (227)	0.0	**8.8**	5.6-13.5							88.5	2.6				**1.8**	**7.0**				
	Enteritidis (134)	0.0	**0.7**	0-4.6							94.8	4.5				**0.7**					
	Heidelberg (28)	3.6	**17.9**	6.8-37.6							78.6				3.6	**7.1**	**10.7**				
	Typhimurium var. 5- (19)	0.0	**5.3**	0.3-28.2							94.7						**5.3**				
	Infantis (16)	0.0	**6.2**	0.3-32.2							93.8					**6.2**					
	Typhimurium (11)	0.0	**9.1**	0.5-42.9							81.8			9.1			**9.1**				
Cephems																					
Cefoxitin	Kentucky (227)	0.4	**8.8**	5.6-13.5						0.4	28.2	55.5	6.2	0.4	0.4	**8.4**	**0.4**				
	Enteritidis (134)	0.0	**0.7**	0-4.6							1.5	83.6	12.7	1.5			**0.7**				
	Heidelberg (28)	0.0	**17.9**	6.8-37.6							39.3	42.9				**14.3**	**3.6**				
	Typhimurium var. 5- (19)	0.0	**5.3**	0.3-28.2							5.3	68.4	21.1				**5.3**				
	Infantis (16)	0.0	**6.2**	0.3-32.2								12.5	81.2				**6.2**				
	Typhimurium (11)	0.0	**9.1**	0.5-42.9							9.1	63.6	18.2			**9.1**					
Ceftiofur	Kentucky (227)	0.4	**8.4**	5.3-13.0				0.9	2.2	67.0	20.7	0.4	0.4		**8.4**						
	Enteritidis (134)	0.7	**0.7**	0-4.6						3.7	92.5	2.2	0.7		**0.7**						
	Heidelberg (28)	0.0	**17.9**	6.8-37.6						53.6	28.6				**17.9**						
	Typhimurium var. 5- (19)	0.0	**5.3**	0.3-28.2						73.7	21.1				**5.3**						
	Infantis (16)	0.0	**6.2**	0.3-32.2							93.8				**6.2**						
	Typhimurium (11)	0.0	**9.1**	0.5-42.9						27.3	54.5	9.1			**9.1**						
Ceftriaxone	Kentucky (227)	0.0	**8.8**	5.6-13.5					90.7	0.4			**0.4**	**1.3**	**6.6**		**0.4**				
	Enteritidis (134)	0.0	**0.7**	0-4.6					98.5	0.7					**0.7**						
	Heidelberg (28)	0.0	**17.9**	6.8-37.6					82.1						**10.7**	**3.6**	**3.6**				
	Typhimurium var. 5- (19)	0.0	**5.3**	0.3-28.2					94.7						**5.3**						
	Infantis (16)	0.0	**6.2**	0.3-32.2					93.8						**6.2**						
	Typhimurium (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, 2011[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 (227)	N/A	**1.3**	0.3-4.1											14.1	74.0	10.6			**1.3**	
	Enteritidis (134)	N/A	**0.0**	0.0-3.5											3.0	55.2	41.0	0.7			
	Heidelberg (28)	N/A	**17.9**	6.8-37.6											57.1	21.4	3.6			**17.9**	
	Typhimurium var. 5- (19)	N/A	**84.2**	59.5-95.8											5.3	10.5				**84.2**	
	Infantis (16)	N/A	**0.0**	0.0-24.1												50.0	50.0				
	Typhimurium (11)	N/A	**45.5**	18.2-75.5											27.3	18.2	9.1			**45.5**	
Trimethoprim-Sulfamethoxazole	Kentucky (227)	N/A	**0.0**	0.0-2.1				100.0													
	Enteritidis (134)	N/A	**0.0**	0.0-3.5				100.0													
	Heidelberg (28)	N/A	**0.0**	0.0-15.0				100.0													
	Typhimurium var. 5- (19)	N/A	**0.0**	0.0-20.9				100.0													
	Infantis (16)	N/A	**0.0**	0.0-24.1				100.0													
	Typhimurium (11)	N/A	**0.0**	0.0-32.1				90.9	9.1												
Marcrolides																					
Azithromycin	Kentucky (227)	N/A	**0.0**	1.1-5.9				0.4			1.8	30.8	64.3	2.6							
	Enteritidis (134)	N/A	**0.0**	3.3-12.7								1.5	91.8	6.7							
	Heidelberg (28)	N/A	**0.0**	6.8-37.6								3.6	78.6	17.9							
	Typhimurium var. 5- (19)	N/A	**0.0**	0.0-20.9								10.5	89.5								
	Infantis (16)	N/A	**0.0**	0.0-24.1									100.0								
	Typhimurium (11)	N/A	**0.0**	0.0-32.1								18.2	81.8								
Penicillins																					
Ampicillin	Kentucky (227)	0.0	**8.8**	5.6-13.5							89.9	0.9		0.4			**8.8**				
	Enteritidis (134)	0.0	**1.5**	0.3-5.8							91.0	6.7	0.7			**0.7**	**0.7**				
	Heidelberg (28)	0.0	**21.4**	9.0-41.4							78.6						**21.4**				
	Typhimurium var. 5- (19)	0.0	**5.3**	0.3-28.2							94.7						**5.3**				
	Infantis (16)	0.0	**6.2**	0.3-32.2							93.8						**6.2**				
	Typhimurium (11)	0.0	**18.2**	3.2-52.3							81.8						**18.2**				

[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, 2011[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 (227)	0.0	**0.4**	0-2.7								22.0	73.6	4.0			**0.4**				
	Enteritidis (134)	0.0	**0.0**	0.0-3.5									60.4	39.6							
	Heidelberg (28)	7.1	**3.6**	0.2-20.3									42.9	46.4	7.1	**3.6**					
	Typhimurium var. 5- (19)	0.0	**0.0**	0.0-20.9									57.9	42.1							
	Infantis (16)	0.0	**0.0**	0.0-24.1									25.0	75.0							
	Typhimurium (11)	0.0	**0.0**	0.0-32.1									72.7	27.3							
Quinolones																					
Ciprofloxacin	Kentucky (227)	0.0	**0.0**	0.0-2.1	99.6	0.4															
	Enteritidis (134)	0.0	**0.0**	0.0-3.5	70.1	29.9															
	Heidelberg (28)	0.0	**0.0**	0.0-15.0	96.4	3.6															
	Typhimurium var. 5- (19)	0.0	**0.0**	0.0-20.9	100.0																
	Infantis (16)	0.0	**0.0**	0.0-24.1	100.0																
	Typhimurium (11)	0.0	**0.0**	0.0-32.1	100.0																
Nalidixic Acid	Kentucky (227)	N/A	**0.0**	0.0-2.1						0.9	7.5	87.2	4.4								
	Enteritidis (134)	N/A	**0.0**	0.0-3.5								17.9	81.3	0.7							
	Heidelberg (28)	N/A	**0.0**	0.0-15.0								60.7	39.3								
	Typhimurium var. 5- (19)	N/A	**0.0**	0.0-20.9								42.1	57.9								
	Infantis (16)	N/A	**0.0**	0.0-24.1								93.8	6.2								
	Typhimurium (11)	N/A	**0.0**	0.0-32.1								63.6	36.4								
Tetracyclines																					
Tetracycline	Kentucky (227)	0.9	**72.2**	65.8-77.8									26.9	0.9		**0.4**	**71.8**				
	Enteritidis (134)	0.0	**0.7**	0-4.6									99.3			**0.7**					
	Heidelberg (28)	0.0	**10.7**	2.8-29.4									89.3			**3.6**	**7.1**				
	Typhimurium var. 5- (19)	0.0	**78.9**	53.9-93.0									21.1				**78.9**				
	Infantis (16)	0.0	**0.0**	0.0-24.1									100.0								
	Typhimurium (11)	0.0	**45.5**	18.2-75.5									54.5				**45.5**				

[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 6A. Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Turkeys, 2011[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																					
Gentamicin	Hadar (20)	0.0	**20.0**	6.6-44.3					30.0	50.0					**10.0**	**10.0**					
	IIIa 18:z4,z23:- (13)	0.0	**7.7**	0.4-37.9					76.9	15.4					**7.7**						
	Schwarzengrund (10)	0.0	**0.0**	0.0-34.5					50.0	40.0	10.0										
Kanamycin	Hadar (20)	0.0	**10.0**	1.8-33.1										90.0				**10.0**			
	IIIa 18:z4,z23:- (13)	0.0	**0.0**	0.0-28.3										100.0							
	Schwarzengrund (10)	0.0	**0.0**	0.0-34.5										100.0							
Streptomycin	Hadar (20)	N/A	**50.0**	27.9-72.1												50.0	**40.0**	**10.0**			
	IIIa 18:z4,z23:- (13)	N/A	**7.7**	0.4-37.9												92.3	**7.7**				
	Schwarzengrund (10)	N/A	**20.0**	3.5-55.8												80.0		**20.0**			
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Hadar (20)	25.0	**10.0**	1.8-33.1							65.0				25.0		**10.0**				
	IIIa 18:z4,z23:- (13)	0.0	**0.0**	0.0-28.3							100.0										
	Schwarzengrund (10)	0.0	**20.0**	3.5-55.8							80.0					**10.0**	**10.0**				
Cephems																					
Cefoxitin	Hadar (20)	0.0	**10.0**	1.8-33.1								80.0	5.0	5.0			**10.0**				
	IIIa 18:z4,z23:- (13)	0.0	**0.0**	0.0-28.3								100.0									
	Schwarzengrund (10)	0.0	**20.0**	3.5-55.8							10.0	60.0	10.0			**20.0**					
Ceftiofur	Hadar (20)	0.0	**10.0**	1.8-33.1						35.0	55.0				**10.0**						
	IIIa 18:z4,z23:- (13)	0.0	**0.0**	0.0-28.3						100.0											
	Schwarzengrund (10)	0.0	**20.0**	3.5-55.8						50.0	30.0				**20.0**						
Ceftriaxone	Hadar (20)	0.0	**10.0**	1.8-33.1					90.0							**10.0**					
	IIIa 18:z4,z23:- (13)	0.0	**0.0**	0.0-28.3					100.0												
	Schwarzengrund (10)	0.0	**20.0**	3.5-55.8					80.0					**10.0**	**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, 2011[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 (20)	N/A	**20.0**	6.6-44.3											5.0	70.0	5.0			**20.0**	
	IIIa 18:z4,z23:- (13)	N/A	**7.7**	0.4-37.9											38.5	53.8				**7.7**	
	Schwarzengrund (10)	N/A	**30.0**	8.1-64.6											10.0	40.0	20.0			**30.0**	
Trimethoprim-Sulfamethoxazole	Hadar (20)	N/A	**0.0**	0.0-20.0				100.0													
	IIIa 18:z4,z23:- (13)	N/A	**0.0**	0.0-28.3				100.0													
	Schwarzengrund (10)	N/A	**0.0**	0.0-34.5				100.0													
Marcrolides																					
Azithromycin	Hadar (20)	N/A	**0.0**	0.0-20.0								45.0	55.0								
	IIIa 18:z4,z23:- (13)	N/A	**0.0**	2.7-46.4									84.6	15.4							
	Schwarzengrund (10)	N/A	**0.0**	3.5-55.8									80.0	20.0							
Penicillins																					
Ampicillin	Hadar (20)	0.0	**35.0**	16.3-59.1							65.0						**35.0**				
	IIIa 18:z4,z23:- (13)	0.0	**0.0**	0.0-28.3							100.0										
	Schwarzengrund (10)	0.0	**20.0**	3.5-55.8							80.0						**20.0**				
Phenicols																					
Chloramphenicol	Hadar (20)	0.0	**0.0**	0.0-20.0								10.0	90.0								
	IIIa 18:z4,z23:- (13)	0.0	**0.0**	0.0-28.3								23.1	76.9								
	Schwarzengrund (10)	0.0	**10.0**	0.5-45.9									60.0	30.0			**10.0**				
Quinolones																					
Ciprofloxacin	Hadar (20)	0.0	**0.0**	0.0-20.0	90.0	10.0															
	IIIa 18:z4,z23:- (13)	0.0	**0.0**	0.0-28.3	100.0																
	Schwarzengrund (10)	0.0	**0.0**	0.0-34.5	90.0	10.0															
Nalidixic Acid	Hadar (20)	0.0	**0.0**	0.0-20.0								75.0	25.0								
	IIIa 18:z4,z23:- (13)	0.0	**0.0**	0.0-28.3							7.7	84.6	7.7								
	Schwarzengrund (10)	0.0	**0.0**	0.0-34.5								70.0	30.0								
Tetracyclines																					
Tetracycline	Hadar (20)	0.0	**85.0**	61.1-96.0									15.0				**85.0**				
	IIIa 18:z4,z23:- (13)	0.0	**0.0**	0.0-28.3									100.0								
	Schwarzengrund (10)	0.0	**40.0**	13.7-72.6									60.0				**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 7A. Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Cattle, 2011[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																					
Gentamicin	Montevideo (99)	0.0	**1.0**	0.1-6.3					30.3	62.6	5.1	1.0		1.0							
	Dublin (38)	0.0	**18.4**	8.3-34.9					13.2	52.6	13.2		2.6			**18.4**					
	Muenster (24)	0.0	**0.0**	0.0-17.2					66.7	33.3											
	Kentucky (18)	0.0	**0.0**	0.0-21.9					22.2	77.8											
	Anatum (17)	0.0	**0.0**	0.0-22.9					58.8	41.2											
	Infantis (15)	0.0	**0.0**	0.0-25.3					73.3	26.7											
	Cerro (14)	0.0	**0.0**	0.0-26.8					50.0	50.0											
	Meleagridis (14)	0.0	**0.0**	0.0-26.8					42.9	50.0	7.1										
	Newport (13)	0.0	**0.0**	0.0-28.3					46.2	46.2	7.7										
	Typhimurium (11)	0.0	**0.0**	0.0-32.1					18.2	72.7	9.1										
Kanamycin	Montevideo (99)	0.0	**0.0**	0.0-4.7										99.0	1.0						
	Dublin (38)	0.0	**47.4**	31.3-64.0										52.6			**5.3**	**42.1**			
	Muenster (24)	0.0	**0.0**	0.0-17.2										100.0							
	Kentucky (18)	0.0	**0.0**	0.0-21.9										100.0							
	Anatum (17)	0.0	**0.0**	0.0-22.9										100.0							
	Infantis (15)	0.0	**0.0**	0.0-25.3										100.0							
	Cerro (14)	0.0	**0.0**	0.0-26.8										100.0							
	Meleagridis (14)	0.0	**0.0**	0.0-26.8										92.9	7.1						
	Newport (13)	0.0	**7.7**	0.4-37.9										92.3				**7.7**			
	Typhimurium (11)	0.0	**9.1**	0.5-42.9										90.9				**9.1**			
Streptomycin	Montevideo (99)	N/A	**5.1**	1.9-12.0												94.9	**1.0**	**4.0**			
	Dublin (38)	N/A	**73.7**	56.6-86.0												26.3	**2.6**	**71.1**			
	Muenster (24)	N/A	**0.0**	0.0-17.2												100.0					
	Kentucky (18)	N/A	**16.7**	4.4-42.3												83.3	**5.6**	**11.1**			
	Anatum (17)	N/A	**0.0**	0.0-22.9												100.0					
	Infantis (15)	N/A	**6.7**	0.4-34.0												93.3		**6.7**			
	Cerro (14)	N/A	**0.0**	0.0-26.8												100.0					
	Meleagridis (14)	N/A	**21.4**	5.7-51.2												78.6	**7.1**	**14.3**			
	Newport (13)	N/A	**76.9**	46.0-93.8												23.1		**76.9**			
	Typhimurium (11)	N/A	**54.5**	24.5-81.8												45.5		**54.5**			
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Montevideo (99)	0.0	**4.0**	1.3-10.6							96.0						**4.0**				
	Dublin (38)	5.3	**57.9**	40.9-73.3							15.8	13.2	5.3	2.6	5.3	**7.9**	**50.0**				
	Muenster (24)	0.0	**0.0**	0.0-17.2							95.8	4.2									
	Kentucky (18)	0.0	**0.0**	0.0-21.9							94.4		5.6								
	Anatum (17)	0.0	**0.0**	0.0-22.9							100.0										
	Infantis (15)	0.0	**6.7**	0.4-34.0							86.7	6.7				**6.7**					
	Cerro (14)	0.0	**0.0**	0.0-26.8							100.0										
	Meleagridis (14)	0.0	**7.1**	0.4-35.8							92.9						**7.1**				
	Newport (13)	0.0	**76.9**	46.0-93.8							23.1					**30.8**	**46.2**				
	Typhimurium (11)	9.1	**36.4**	12.4-68.4							45.5			9.1	9.1	**9.1**	**27.3**				

[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, 2011[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 (99)	0.0	**4.0**	1.3-10.6							16.2	73.7	5.1	1.0		**3.0**	**1.0**				
	Dublin (38)	5.3	**47.4**	31.3-64.0							2.6	5.3	21.1	18.4	5.3	**5.3**	**42.1**				
	Muenster (24)	4.2	**0.0**	0.0-17.2									95.8		4.2						
	Kentucky (18)	0.0	**0.0**	0.0-21.9								55.6	38.9	5.6							
	Anatum (17)	0.0	**0.0**	0.0-22.9									100.0								
	Infantis (15)	6.7	**6.7**	0.4-34.0									86.7		6.7		**6.7**				
	Cerro (14)	0.0	**0.0**	0.0-26.8							7.1	64.3	28.6								
	Meleagridis (14)	0.0	**7.1**	0.4-35.8									92.9				**7.1**				
	Newport (13)	0.0	**76.9**	46.0-93.8								23.1				**23.1**	**53.8**				
	Typhimurium (11)	0.0	**36.4**	12.4-68.4							9.1	54.5				**18.2**	**18.2**				
Ceftiofur	Montevideo (99)	0.0	**4.0**	1.3-10.6						65.7	29.3	1.0			**4.0**						
	Dublin (38)	10.5	**47.4**	31.3-64.0					5.3	23.7	13.2		10.5	**13.2**	**34.2**						
	Muenster (24)	0.0	**0.0**	0.0-17.2							95.8	4.2									
	Kentucky (18)	0.0	**0.0**	0.0-21.9						22.2	77.8										
	Anatum (17)	0.0	**0.0**	0.0-22.9						11.8	88.2										
	Infantis (15)	0.0	**6.7**	0.4-34.0							86.7	6.7			**6.7**						
	Cerro (14)	0.0	**0.0**	0.0-26.8						50.0	50.0										
	Meleagridis (14)	0.0	**7.1**	0.4-35.8							92.9				**7.1**						
	Newport (13)	0.0	**76.9**	46.0-93.8							23.1				**76.9**						
	Typhimurium (11)	0.0	**36.4**	12.4-68.4						36.4	27.3				**36.4**						
Ceftriaxone	Montevideo (99)	0.0	**4.0**	1.3-10.6					96.0					2.0	2.0						
	Dublin (38)	2.6	**55.3**	38.5-71.0					42.1			2.6	**7.9**	**7.9**	**13.2**	**23.7**	**2.6**				
	Muenster (24)	0.0	**0.0**	0.0-17.2					100.0												
	Kentucky (18)	0.0	**0.0**	0.0-21.9					100.0												
	Anatum (17)	0.0	**0.0**	0.0-22.9					100.0												
	Infantis (15)	0.0	**6.7**	0.4-34.0					93.3						**6.7**						
	Cerro (14)	0.0	**0.0**	0.0-26.8					100.0												
	Meleagridis (14)	0.0	**7.1**	0.4-35.8					92.9									**7.1**			
	Newport (13)	0.0	**76.9**	46.0-93.8					23.1						**15.4**	**61.5**					
	Typhimurium (11)	0.0	**36.4**	12.4-68.4					63.6					**9.1**	**27.3**						
Marcrolides																					
Azithromycin	Montevideo (99)	N/A	**0.0**	13.1-29.7									79.8	20.2							
	Dublin (38)	N/A	**0.0**	3.4-25.7								7.9	81.6	10.5							
	Muenster (24)	N/A	**0.0**	3.3-33.5								8.3	79.2	8.3	4.2						
	Kentucky (18)	N/A	**0.0**	0.0-21.9								5.6	94.4								
	Anatum (17)	N/A	**0.0**	2.1-37.8								5.9	82.4	11.8							
	Infantis (15)	N/A	**0.0**	0.4-34.0									93.3	6.7							
	Cerro (14)	N/A	**0.0**	0.0-26.8									100.0								
	Meleagridis (14)	N/A	**7.1**	5.7-51.2									78.6	14.3		**7.1**					
	Newport (13)	N/A	**0.0**	15.2-67.8									61.5	38.5							
	Typhimurium (11)	N/A	**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 7A (continued). Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Cattle, 2011[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	Montevideo (99)	N/A	**4.0**	1.3-10.6											18.2	63.6	14.1			**4.0**	
	Dublin (38)	N/A	**89.5**	74.3-96.6											7.9	2.6				**89.5**	
	Muenster (24)	N/A	**0.0**	0.0-17.2												54.2	41.7	4.2			
	Kentucky (18)	N/A	**0.0**	0.0-21.9											22.2	55.6	22.2				
	Anatum (17)	N/A	**0.0**	0.0-22.9											23.5	52.9	23.5				
	Infantis (15)	N/A	**6.7**	0.4-34.0											6.7	53.3	33.3			**6.7**	
	Cerro (14)	N/A	**0.0**	0.0-26.8											7.1	7.1	64.3	14.3	7.1		
	Meleagridis (14)	N/A	**28.6**	9.6-58.0												35.7	35.7			**28.6**	
	Newport (13)	N/A	**76.9**	46.0-93.8											7.7	7.7	7.7			**76.9**	
	Typhimurium (11)	N/A	**54.5**	24.5-81.8												45.5				**54.5**	
Trimethoprim-Sulfamethoxazole	Montevideo (99)	N/A	**0.0**	0.0-4.7				97.0	3.0												
	Dublin (38)	N/A	**5.3**	0.9-19.1				21.1	57.9	15.8			**2.6**	**2.6**							
	Muenster (24)	N/A	**0.0**	0.0-17.2				100.0													
	Kentucky (18)	N/A	**0.0**	0.0-21.9				100.0													
	Anatum (17)	N/A	**0.0**	0.0-22.9				100.0													
	Infantis (15)	N/A	**6.7**	0.4-34.0				93.3						**6.7**							
	Cerro (14)	N/A	**0.0**	0.0-26.8				100.0													
	Meleagridis (14)	N/A	**7.1**	0.4-35.8				78.6	14.3					**7.1**							
	Newport (13)	N/A	**7.7**	0.4-37.9				61.5	30.8					**7.7**							
	Typhimurium (11)	N/A	**0.0**	0.0-32.1				90.9	9.1												
Penicillins																					
Ampicillin	Montevideo (99)	0.0	**4.0**	1.3-10.6							96.0						**4.0**				
	Dublin (38)	0.0	**71.1**	53.9-84.1							15.8	10.5	2.6				**71.1**				
	Muenster (24)	0.0	**0.0**	0.0-17.2							95.8		4.2								
	Kentucky (18)	0.0	**0.0**	0.0-21.9							94.4		5.6								
	Anatum (17)	0.0	**0.0**	0.0-22.9							100.0										
	Infantis (15)	0.0	**6.7**	0.4-34.0							86.7	6.7					**6.7**				
	Cerro (14)	0.0	**0.0**	0.0-26.8							100.0										
	Meleagridis (14)	0.0	**7.1**	0.4-35.8							92.9						**7.1**				
	Newport (13)	0.0	**76.9**	46.0-93.8							23.1						**76.9**				
	Typhimurium (11)	0.0	**54.5**	24.5-81.8							45.5						**54.5**				

[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, 2011[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	Montevideo (99)	0.0	**4.0**	1.3-10.6									51.5	44.4			**4.0**				
	Dublin (38)	0.0	**81.6**	65.1-91.7									13.2	5.3			**81.6**				
	Muenster (24)	0.0	**4.2**	0.2-23.2									29.2	66.7		**4.2**					
	Kentucky (18)	0.0	**0.0**	0.0-21.9								5.6	66.7	27.8							
	Anatum (17)	0.0	**0.0**	0.0-22.9									52.9	47.1							
	Infantis (15)	0.0	**6.7**	0.4-34.0									20.0	73.3			**6.7**				
	Cerro (14)	0.0	**0.0**	0.0-26.8									92.9	7.1							
	Meleagridis (14)	0.0	**14.3**	2.5-43.9									57.1	28.6			**14.3**				
	Newport (13)	0.0	**76.9**	46.0-93.8									15.4	7.7			**76.9**				
	Typhimurium (11)	0.0	**45.5**	18.2-75.5									45.5	9.1			**45.5**				
Quinolones																					
Ciprofloxacin	Montevideo (99)	0.0	**0.0**	0.0-4.7	100.0																
	Dublin (38)	13.2	**0.0**	0.0-11.4	52.6	34.2		5.3	5.3	2.6											
	Muenster (24)	0.0	**0.0**	0.0-17.2	95.8		4.2														
	Kentucky (18)	0.0	**0.0**	0.0-21.9	100.0																
	Anatum (17)	0.0	**0.0**	0.0-22.9	100.0																
	Infantis (15)	0.0	**0.0**	0.0-25.3	100.0																
	Cerro (14)	0.0	**0.0**	0.0-26.8	100.0																
	Meleagridis (14)	0.0	**7.1**	0.4-35.8	85.7	7.1								**7.1**							
	Newport (13)	0.0	**0.0**	0.0-28.3	100.0																
	Typhimurium (11)	0.0	**0.0**	0.0-32.1	90.9	9.1															
Nalidixic Acid	Montevideo (99)	N/A	**0.0**	0.0-4.7								94.9	5.1								
	Dublin (38)	N/A	**10.5**	3.4-25.7								21.1	63.2	2.6	2.6	**2.6**	**7.9**				
	Muenster (24)	N/A	**0.0**	0.0-17.2								37.5	58.3	4.2							
	Kentucky (18)	N/A	**0.0**	0.0-21.9								66.7	33.3								
	Anatum (17)	N/A	**0.0**	0.0-22.9								41.2	58.8								
	Infantis (15)	N/A	**0.0**	0.0-25.3								93.3	6.7								
	Cerro (14)	N/A	**0.0**	0.0-26.8								92.9	7.1								
	Meleagridis (14)	N/A	**7.1**	0.4-35.8									92.9				**7.1**				
	Newport (13)	N/A	**0.0**	0.0-28.3								23.1	76.9								
	Typhimurium (11)	N/A	**0.0**	0.0-32.1								63.6	36.4								
Tetracyclines																					
Tetracycline	Montevideo (99)	1.0	**17.2**	10.6-26.4									81.8	1.0	**1.0**	**1.0**	**15.2**				
	Dublin (38)	0.0	**92.1**	77.5-97.9									7.9				**92.1**				
	Muenster (24)	0.0	**8.3**	1.4-28.4									91.7			**4.2**	**4.2**				
	Kentucky (18)	0.0	**38.9**	18.3-63.9									61.1		**5.6**	**16.7**	**16.7**				
	Anatum (17)	0.0	**11.8**	2.1-37.8									88.2			**5.9**	**5.9**				
	Infantis (15)	0.0	**6.7**	0.4-34.0									93.3				**6.7**				
	Cerro (14)	0.0	**7.1**	0.4-35.8									92.9		**7.1**						
	Meleagridis (14)	0.0	**50.0**	24.0-76.0									50.0				**50.0**				
	Newport (13)	0.0	**76.9**	46.0-93.8									23.1				**76.9**				
	Typhimurium (11)	0.0	**54.5**	24.5-81.8									45.5			**9.1**	**45.5**				

[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, 2011[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																					
Gentamicin	Adelaide (13)	0.0	**0.0**	0.0-28.3					92.3	7.7											
	Johannesburg (12)	0.0	**0.0**	0.0-30.1					83.3	16.7											
	Derby (10)	0.0	**0.0**	0.0-34.5					50.0	50.0											
	Infantis (10)	0.0	**0.0**	0.0-34.5					90.0	10.0											
Kanamycin	Adelaide (13)	0.0	**0.0**	0.0-28.3										100.0							
	Johannesburg (12)	0.0	**0.0**	0.0-30.1										100.0							
	Derby (10)	0.0	**0.0**	0.0-34.5										100.0							
	Infantis (10)	0.0	**20.0**	3.5-55.8										80.0				**20.0**			
Streptomycin	Adelaide (13)	0.0	**0.0**	0.0-28.3												100.0					
	Johannesburg (12)	0.0	**0.0**	0.0-30.1												100.0					
	Derby (10)	0.0	**40.0**	13.7-72.6												60.0		**40.0**			
	Infantis (10)	0.0	**30.0**	8.1-64.6												70.0	**20.0**	**10.0**			
β-Lactam/β-Lactamase Inhibitor Combinations																					
Amoxicillin-Clavulanic Acid	Adelaide (13)	0.0	**0.0**	0.0-28.3							100.0										
	Johannesburg (12)	0.0	**0.0**	0.0-30.1							100.0										
	Derby (10)	0.0	**0.0**	0.0-34.5							100.0										
	Infantis (10)	0.0	**10.0**	0.5-45.9							70.0		20.0			**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, 2011[1]

	Serotype				Distribution (%) of MICs (µg/ml)[5]																
Antimicrobial	**(# 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**
Cephems																					
Cefoxitin	Adelaide (13)	0.0	**0.0**	0.0-28.3								7.7	92.3								
	Johannesburg (12)	0.0	**0.0**	0.0-30.1								83.3	16.7								
	Derby (10)	0.0	**0.0**	0.0-34.5								20.0	70.0	10.0							
	Infantis (10)	0.0	**10.0**	0.5-45.9									90.0				**10.0**				
Ceftiofur	Adelaide (13)	0.0	**0.0**	0.0-28.3						7.7	92.3										
	Johannesburg (12)	0.0	**0.0**	0.0-30.1						91.7	8.3										
	Derby (10)	0.0	**0.0**	0.0-34.5						10.0	90.0										
	Infantis (10)	0.0	**10.0**	0.5-45.9							90.0				**10.0**						
Ceftriaxone	Adelaide (13)	0.0	**0.0**	0.0-28.3					100.0												
	Johannesburg (12)	0.0	**0.0**	0.0-30.1					100.0												
	Derby (10)	0.0	**0.0**	0.0-34.5					100.0												
	Infantis (10)	0.0	**10.0**	0.5-45.9					90.0												
Marcrolides																					
Azithromycin	Adelaide (13)	N/A	**0.0**	0.4-37.9									92.3	7.7							
	Johannesburg (12)	N/A	**0.0**	69.9-100										91.7	8.3						
	Derby (10)	N/A	**0.0**	3.5-55.8									80.0	20.0							
	Infantis (10)	N/A	**0.0**	0.5-45.9									90.0	10.0							
Folate Pathway Inhibitors																					
Sulfonamides	Adelaide (13)	N/A	**0.0**	0.0-28.3											100.0						
	Johannesburg (12)	N/A	**0.0**	0.0-30.1											83.3	8.3	8.3				
	Derby (10)	N/A	**40.0**	13.7-72.6												40.0	20.0			**40.0**	
	Infantis (10)	N/A	**10.0**	0.5-45.9											20.0	60.0	10.0			**10.0**	
Trimethoprim-Sulfamethoxazole	Adelaide (13)	N/A	**0.0**	0.0-28.3				100.0													
	Johannesburg (12)	N/A	**0.0**	0.0-30.1				100.0													
	Derby (10)	N/A	**0.0**	0.0-34.5				70.0	30.0												
	Infantis (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 8A (continued). Distribution of MICs and Occurrence of Resistance for Top Serotypes Tested from Swine, 2011[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	Adelaide (13)	0.0	**0.0**	0.0-28.3							100.0										
	Johannesburg (12)	0.0	**0.0**	0.0-30.1							91.7	8.3									
	Derby (10)	0.0	**0.0**	0.0-34.5							90.0	10.0									
	Infantis (10)	0.0	**30.0**	8.1-64.6							60.0	10.0					**30.0**				
Phenicols																					
Chloramphenicol	Adelaide (13)	0.0	**0.0**	0.0-28.3									7.7	92.3							
	Johannesburg (12)	0.0	**0.0**	0.0-30.1									33.3	66.7							
	Derby (10)	0.0	**0.0**	0.0-34.5										100.0							
	Infantis (10)	10.0	**10.0**	0.5-45.9									30.0	50.0	10.0		**10.0**				
Quinolones																					
Ciprofloxacin	Adelaide (13)	0.0	**0.0**	0.0-28.3	100.0																
	Johannesburg (12)	0.0	**0.0**	0.0-30.1	91.7	8.3															
	Derby (10)	0.0	**0.0**	0.0-34.5	90.0	10.0															
	Infantis (10)	0.0	**0.0**	0.0-34.5	90.0	10.0															
Nalidixic Acid	Adelaide (13)	N/A	**0.0**	0.0-28.3								84.6	15.4								
	Johannesburg (12)	N/A	**0.0**	0.0-30.1								83.3	16.7								
	Derby (10)	N/A	**0.0**	0.0-34.5								60.0	40.0								
	Infantis (10)	N/A	**0.0**	0.0-34.5								90.0	10.0								
Tetracyclines																					
Tetracycline	Adelaide (13)	0.0	**0.0**	0.0-28.3									100.0								
	Johannesburg (12)	0.0	**58.3**	28.6-83.5									41.7				**58.3**				
	Derby (10)	0.0	**70.0**	35.4-91.9									30.0				**70.0**				
	Infantis (10)	0.0	**30.0**	8.1-64.6									70.0				**30.0**				

[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, 1997-2011

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
2011	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	1	20.0	1.1

[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, 1997-2011

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of Isolates Tested	214	561	1438	1173	1307	1500	1158	1280	1989	1380	994	624	551	564	491
Resistance Pattern															
No Resistance Detected (Pan-susceptible)	52.8% 113	58.6% 329	58.8% 846	56.9% 668	66.6% 871	62.0% 930	61.1% 708	62.7% 803	61.2% 1217	57.2% 790	53.9% 536	60.4% 377	56.1% 309	49.3% 278	50.7% 249
Resistance ≥1 CLSI Class[1]	47.2% 101	41.4% 232	41.2% 592	43.1% 505	33.4% 436	38.0% 570	39.2% 454	37.3% 477	38.8% 772	42.8% 590	46.1% 458	39.6% 247	43.9% 242	50.7% 286	49.3% 242
Resistance ≥ 2 CLSI Classes[1]	28.0% 60	30.7% 172	31.9% 459	32.2% 378	25.2% 330	28.3% 424	27.2% 315	31.2% 399	31.3% 622	31.4% 434	30.2% 300	33.3% 208	35.8% 197	41.7% 235	39.3% 193
Resistance ≥ 3 CLSI Classes[1]	9.8% 21	13.4% 75	12.3% 177	15.1% 177	10.2% 133	14.2% 213	13.5% 156	15.8% 202	15.1% 301	16.4% 226	17.8% 177	11.4% 71	15.6% 86	15.2% 86	7.9% 39
Resistance ≥ 4 CLSI Classes[1]	3.3% 7	3.9% 22	4.9% 71	6.7% 79	3.6% 47	7.7% 115	6.8% 79	9.8% 126	8.7% 174	10.3% 142	12.3% 122	7.5% 47	11.1% 61	11.3% 64	5.1% 25
Resistance ≥ 5 CLSI Classes[1]	1.4% 3	2.7% 15	3.0% 43	5.5% 64	3.1% 41	5.7% 85	4.9% 57	8.0% 103	5.9% 117	6.6% 91	7.4% 74	6.1% 38	7.8% 43	9.0% 51	3.5% 17
At Least ACSSuT[2]	1.4% 3	2.7% 15	1.7% 24	4.3% 50	2.4% 32	1.9% 29	1.5% 17	0.9% 12	1.6% 31	1.6% 22	1.5% 15	1.4% 9	1.3% 7	2.3% 13	0.4% 2
At Least ACT/S[3]	0.0% 0	0.2% 1	0.1% 2	0.0% 0	0.1% 1	0.0% 0	0.0% 0	0.1% 1	0.1% 2	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0
At Least ACSSuTAuCx[4]	0.0% 0	0.5% 3	0.3% 4	2.7% 32	1.1% 14	0.9% 13	1.0% 12	0.4% 5	0.9% 18	1.1% 15	1.4% 14	1.1% 7	1.3% 7	2.0% 11	0.4% 2
At Least Ceftriaxone and Nalidixic Acid Resistant	0.0% 0	0.0% 0	0.1% 1	0.1% 1	0.0% 0	0.5% 8	0.0% 0	0.2% 2	0.1% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0

Table 11A. MDR *Salmonella* from Turkeys, 1997-2011

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of Isolates Tested	107	240	713	518	550	244	262	236	227	304	271	148	121	151	103
Resistance Pattern															
No Resistance Detected (Pan-susceptible)	32.7% 35	41.3% 99	32.5% 232	33.4% 173	31.6% 174	29.9% 73	24.0% 63	33.5% 79	27.8% 63	28.0% 85	15.5% 42	21.6% 32	19.8% 24	25.2% 38	40.8% 42
Resistance ≥1 CLSI Class[1]	67.3% 72	58.8% 141	67.5% 481	66.6% 345	68.4% 376	70.1% 171	76.0% 199	66.5% 157	72.2% 164	71.4% 219	84.5% 229	78.4% 116	80.2% 97	74.8% 113	59.2% 61
Resistance ≥ 2 CLSI Classes[1]	48.6% 52	45.0% 108	53.3% 380	51.0% 264	56.2% 309	46.3% 113	42.7% 112	50.0% 118	53.3% 121	37.5% 141	60.1% 163	55.4% 82	67.8% 82	59.6% 90	46.6% 48
Resistance ≥ 3 CLSI Classes[1]	25.2% 27	23.8% 57	26.2% 187	21.6% 112	30.4% 167	24.2% 59	21.8% 57	27.1% 64	28.2% 64	27.3% 83	33.6% 91	29.7% 44	33.1% 40	37.1% 56	23.3% 24
Resistance ≥ 4 CLSI Classes[1]	5.6% 6	6.3% 15	10.8% 77	10.0% 52	14.7% 81	11.1% 27	9.5% 25	10.2% 24	11.5% 26	12.2% 37	15.1% 41	10.1% 15	11.6% 14	17.9% 27	11.7% 12
Resistance ≥ 5 CLSI Classes[1]	4.7% 5	0.8% 2	5.0% 36	4.8% 25	6.0% 33	6.6% 16	3.1% 8	5.5% 13	6.2% 14	5.9% 18	7.0% 19	4.1% 6	9.1% 11	9.3% 14	6.8% 7
At Least ACSSuT[2]	3.7% 4	0.8% 2	3.8% 27	3.3% 17	3.6% 20	4.5% 11	2.3% 6	4.7% 11	4.0% 9	3.9% 12	4.8% 13	2.0% 3	3.3% 4	4.0% 6	1.0% 1
At Least ACT/S[3]	0.0% 0	0.4% 1	0.4% 3	0.8% 4	0.7% 4	0.8% 2	0.0% 0	0.4% 1	0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.8% 1	0.0% 0	0.0% 0
At Least ACSSuTAuCx[4]	3.7% 4	0.4% 1	3.4% 24	1.9% 10	2.9% 16	1.6% 4	0.8% 2	2.1% 5	1.8% 4	2.3% 7	4.1% 11	2.0% 3	3.3% 4	1.3% 2	1.0% 1
At Least Ceftriaxone and Nalidixic Acid Resistant	1.9% 2	0.0% 0	2.7% 19	1.2% 6	1.5% 8	1.2% 3	0.4% 1	0.8% 2	0.9% 2	0.3% 1	0.7% 2	0.0% 0	0.0% 0	0.7% 1	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

Table 12A. MDR *Salmonella* from Cattle, 1997-2011

Year	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Number of Isolates Tested	24	284	1610	1388	893	1008	670	607	329	389	439	443	200	247	340
Resistance Pattern															
No Resistance Detected (Pan-susceptible)	66.7% 16	73.2% 208	74.5% 1200	70.0% 972	69.9% 624	64.3% 648	61.0% 409	65.6% 398	63.2% 208	67.6% 263	72.0% 316	68.8% 305	68.5% 137	61.1% 151	67.6% 230
Resistance ≥1 CLSI Class[1]	33.3% 8	26.8% 76	25.5% 410	30.0% 416	30.1% 269	35.7% 360	39.0% 261	34.4% 209	36.8% 121	32.4% 126	28.0% 123	31.2% 138	31.5% 63	38.9% 96	32.4% 110
Resistance ≥ 2 CLSI Classes[1]	20.8% 5	17.3% 49	15.8% 254	21.8% 303	21.6% 193	27.9% 281	31.8% 213	23.9% 145	28.6% 94	26.0% 101	22.8% 101	25.7% 114	26.5% 53	32.4% 80	22.4% 76
Resistance ≥ 3 CLSI Classes[1]	12.5% 3	13.7% 39	13.3% 214	19.8% 275	18.9% 169	24.5% 247	29.6% 198	21.1% 128	27.7% 91	23.9% 93	22.1% 97	23.5% 104	26.0% 52	28.7% 71	20.0% 68
Resistance ≥ 4 CLSI Classes[1]	8.3% 2	9.2% 26	10.9% 175	17.4% 242	16.9% 151	22.1% 223	27.5% 184	18.8% 114	24.9% 82	22.1% 86	21.0% 92	21.9% 97	24.5% 49	25.5% 63	19.4% 66
Resistance ≥ 5 CLSI Classes[1]	8.3% 2	4.6% 13	8.0% 128	14.0% 195	15.1% 135	19.3% 195	23.6% 158	17.8% 108	23.1% 76	20.1% 78	18.9% 83	19.0% 84	20.0% 40	23.1% 57	16.2% 55
At Least ACSSuT[2]	4.2% 1	4.2% 12	7.6% 123	13.1% 182	14.6% 130	17.1% 172	18.1% 121	16.3% 99	20.4% 67	18.3% 71	16.2% 71	18.1% 80	15.0% 30	18.6% 46	12.6% 43
At Least ACT/S[3]	0.0% 0	2.1% 6	2.2% 35	1.7% 23	2.4% 21	2.4% 24	2.7% 18	1.2% 7	4.3% 14	4.1% 16	2.5% 11	0.0% 0	1.5% 3	4.5% 11	1.5% 5
At Least ACSSuTAuCx[4]	0.0% 0	2.1% 6	3.7% 59	8.9% 124	11.0% 98	14.6% 147	15.1% 101	12.0% 73	17.3% 57	16.2% 63	13.9% 61	14.7% 65	9.5% 19	16.2% 40	11.2% 38
At Least Ceftriaxone and Nalidixic Acid Resistant	0.0% 0	0.0% 0	0.1% 1	0.1% 1	0.3% 3	0.2% 2	0.4% 3	1.0% 6	0.9% 3	0.3% 1	0.2% 1	0.7% 3	0.0% 0	1.2% 3	0.9% 3

Table 13A. MDR *Salmonella* from Swine, 1997-2011

Year	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Number of Isolates Tested	111	793	876	451	418	379	211	308	301	304	211	111	120	111	90
Resistance Pattern															
No Resistance Detected (Pan-susceptible)	44.1% 49	49.2% 390	48.9% 428	43.2% 195	43.5% 182	40.1% 152	53.6% 113	37.3% 115	44.5% 134	34.5% 105	43.1% 91	47.7% 53	44.2% 53	44.1% 49	57.8% 52
Resistance ≥1 CLSI Class[1]	55.9% 62	50.8% 403	51.1% 448	56.8% 256	56.5% 236	59.9% 227	46.4% 98	62.7% 193	55.5% 167	65.5% 199	56.9% 120	52.3% 58	55.8% 67	55.9% 62	42.2% 38
Resistance ≥2 CLSI Classes[1]	43.2% 48	34.4% 273	35.3% 309	44.6% 201	40.2% 168	43.3% 164	34.1% 72	41.2% 127	40.5% 122	36.2% 110	38.4% 81	36.9% 41	35.8% 43	39.6% 44	22.2% 20
Resistance ≥3 CLSI Classes[1]	26.1% 29	24.0% 190	26.4% 231	34.6% 156	30.6% 128	34.0% 129	23.7% 50	33.4% 103	31.9% 96	22.7% 69	28.0% 59	29.7% 33	31.7% 38	27.9% 31	15.6% 14
Resistance ≥4 CLSI Classes[1]	15.3% 17	11.2% 89	9.8% 86	17.1% 77	9.1% 38	12.7% 48	10.9% 23	15.3% 47	13.3% 40	9.5% 29	17.5% 37	14.4% 16	15.0% 18	11.7% 13	8.9% 8
Resistance ≥5 CLSI Classes[1]	4.5% 5	8.1% 64	7.3% 64	9.3% 42	7.2% 30	9.0% 34	9.5% 20	12.3% 38	10.3% 31	5.9% 18	11.4% 24	8.1% 9	14.2% 17	7.2% 8	4.4% 4
At Least ACSSuT[2]	4.5% 5	7.8% 62	7.1% 62	8.6% 39	7.2% 30	7.7% 29	7.6% 16	12.0% 37	9.6% 29	5.3% 16	10.9% 23	8.1% 9	13.3% 16	7.2% 8	4.4% 4
At Least ACT/S[3]	0.0% 0	0.5% 4	0.5% 4	0.0% 0	1.0% 4	0.5% 2	0.9% 2	0.6% 2	1.7% 5	0.3% 1	1.9% 4	0.0% 0	1.7% 2	0.0% 0	0.0% 0
At Least ACSSuTAuCx[4]	0.0% 0	0.1% 1	0.5% 4	1.3% 6	2.2% 9	1.8% 7	1.9% 4	1.0% 3	2.7% 8	0.7% 2	0.5% 1	0.9% 1	1.7% 2	0.9% 1	2.2% 2
At Least Ceftriaxone and Nalidixic Acid Resistant	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.3% 1	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 0	0.0% 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, 1998-2011[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**	**2011** **n=577**
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	40.4% 233
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	59.6% 344
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	0.0% 0

[1] Differences in isolation methods are described in the section on methods

Figure 1B. *Campylobacter* Species Tested from Chickens, 1998-2011

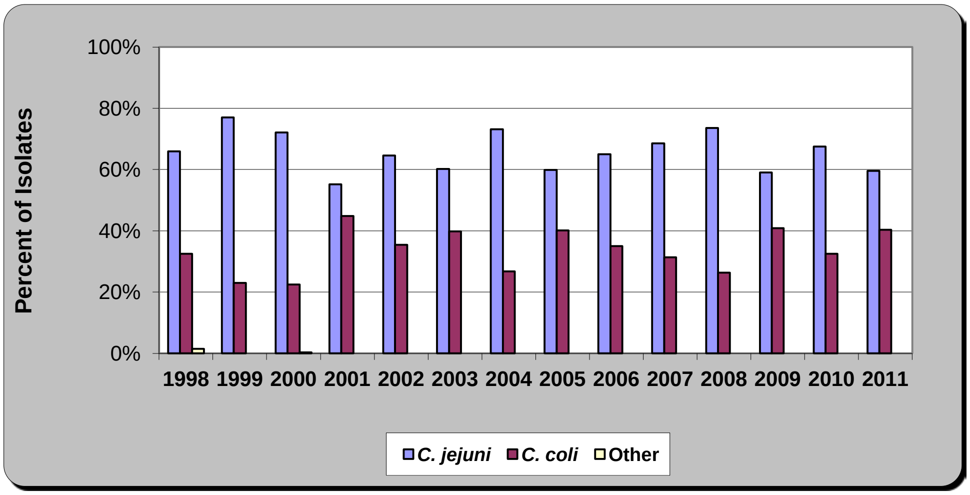


Table 2B. Distribution of MICs and Occurrence of Resistance among *Campylobacter* from Chickens, 2011

Antimicrobial	**Isolate Species (# of Isolates)** ***C. coli* (233)** ***C. jejuni* (344)**	**%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**
Aminoglycosides																		
Gentamicin	*C. coli*	0.0	**5.6**	3.1-9.6					3.9	85.4	5.2						**5.6**	
	C. jejuni	0.0	**0.3**	0-1.9				2.0	19.2	72.4	6.1						**0.3**	
Lincosamides																		
Clindamicin	*C. coli*	2.1	**0.0**	0.0-2.0			2.1	45.9	44.6	4.3	0.4	0.4	2.1					
	C. jejuni	0.0	**0.3**	0-1.9		1.5	28.2	59.0	9.9	0.3	0.6	0.3		**0.3**				
Macrolides/Ketolides																		
Azithromycin	*C. coli*	0.0	**3.4**	1.6-6.9	0.4	9.4	76.4	9.9				0.4						**3.4**
	C. jejuni	0.0	**0.6**	0.1-2.3	9.0	63.4	23.3	3.2	0.3	0.3								**0.6**
Erythromycin	*C. coli*	0.0	**3.4**	1.6-6.9				3.9	19.7	37.3	34.3	1.3					**0.4**	**3.0**
	C. jejuni	0.0	**0.6**	0.1-2.3			0.6	13.4	45.3	33.7	5.8	0.3	0.3					**0.6**
Telithromycin	*C. coli*	0.4	**2.6**	1.1-5.8				2.1	16.7	10.3	43.3	24.0	0.4	0.4	**2.6**			
	C. jejuni	0.3	**0.3**	0-1.9			0.3	1.5	27.9	47.7	19.5	2.6		0.3	**0.3**			
Phenicols																		
Florfenicol	*C. coli*	N/A	**0.0**	0.0-2.0						9.4	86.3	4.3						
	C. jejuni	N/A	**0.0**	0.0-1.4					0.9	46.8	50.9	1.5						
Quinolones																		
Ciprofloxacin	*C. coli*	0.0	**27.9**	22.3-34.2			12.0	47.6	12.4				**1.3**	**11.6**	**15.0**			
	C. jejuni	0.0	**19.2**	15.3-23.8		0.6	47.7	27.6	4.4	0.3	0.3		**1.2**	**9.0**	**8.4**	**0.6**		
Nalidixic acid	*C. coli*	0.4	**27.5**	22.0-33.8									58.8	13.3		0.4	**18.9**	**8.6**
	C. jejuni	1.2	**19.2**	15.3-23.8									65.7	14.0		1.2	**3.8**	**15.4**
Tetracyclines																		
Tetracycline	*C. coli*	0.0	**42.1**	35.7-48.7				4.7	32.6	10.7	9.4	0.4			**0.4**	**1.7**	**4.7**	**35.2**
	C. jejuni	0.3	**45.1**	39.8-50.5			1.5	27.9	18.9	4.7	1.2	0.6		0.3	**1.7**	**4.1**	**18.0**	**21.2**

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

[3] 95% confidence intervals for percent resistant (%R) were calculated using the 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, 1998-2011[1,2]

Year			**1998**	**1999**	**2000**	**2001[3]**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Number of Isolates Tested		*C. coli*	63	168	172	52	288	247	186	380	123	76	28	81	100	233
		C. jejuni	128	563	590	64	526	374	508	567	228	166	78	117	208	344
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	5.6% 13
		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	0.3% 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	0.0% 0
		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	0.3% 1
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	3.4% 8
		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	0.6% 2
	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	3.4% 8
		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	0.6% 2
	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	2.6% 6
		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	0.3% 1
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	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	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	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	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	27.9% 65
		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	19.2% 66
	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	27.5% 64
		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	19.2% 66
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	42.1% 98
		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	45.1% 155

[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, 1998-2011

Year	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Number of Isolates Tested	63	168	172	52	288	247	186	380	123	76	28	81	100	233
Resistance Pattern														
No Resistance Detected	19.0%	33.3%	27.9%	30.8%	37.5%	32.8%	37.1%	47.6%	39.0%	43.4%	28.6%	49.4%	34.0%	42.1%
	12	56	48	16	108	81	69	181	48	33	8	40	34	98
Resistance ≥1 CLSI Class[1]	81.0%	66.7%	72.1%	69.2%	62.5%	67.2%	62.9%	52.4%	61.0%	56.6%	71.4%	50.6%	66.0%	57.9%
	51	112	124	36	180	166	117	199	75	43	20	41	66	135
Resistance ≥2 CLSI Classes[1]	42.9%	21.4%	26.7%	21.2%	23.6%	27.9%	22.0%	21.6%	17.9%	21.1%	17.9%	19.8%	25.0%	18.5%
	27	36	46	11	68	69	41	82	22	16	5	16	25	43
Resistance ≥3 CLSI Classes[1]	14.3%	12.5%	9.9%	3.8%	6.9%	6.5%	4.8%	5.8%	6.5%	13.2%	17.9%	6.2%	4.0%	4.3%
	9	21	17	2	20	16	9	22	8	10	2	5	4	10
Resistance ≥4 CLSI Classes[1]	1.6%	3.0%	0.6%	0.0%	2.1%	0.4%	0.5%	1.3%	0.8%	3.9%	3.6%	4.9%	0.0%	0.9%
	1	5	1	0	6	1	1	5	1	3	0	4	0	2
Resistance ≥5 CLSI Classes[1]	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%	0.0%
	0	0	0	0	0	0	0	0	0	1	0	0	0	0

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

Table 5B. MDR *C. jejuni* from Chickens, 1998-2011

Year	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Number of Isolates Tested	128	563	590	64	526	374	508	567	228	166	78	117	208	344
Resistance Pattern														
No Resistance Detected	38.3%	42.6%	42.2%	53.1%	44.9%	45.5%	48.2%	46.9%	39.9%	34.3%	33.3%	41.9%	44.7%	48.3%
	49	240	249	34	236	170	245	266	91	57	26	49	93	166
Resistance ≥1 CLSI Class[1]	61.7%	57.4%	57.8%	46.9%	55.1%	54.5%	51.8%	53.1%	60.1%	65.7%	66.7%	58.1%	55.3%	51.7%
	79	323	341	30	290	204	263	301	137	109	52	68	115	178
Resistance ≥2 CLSI Classes[1]	13.3%	8.5%	8.0%	10.9%	13.3%	9.6%	13.0%	8.3%	5.3%	12.7%	33.3%	12.0%	15.9%	14.0%
	17	48	47	7	70	36	66	47	12	21	18	14	33	48
Resistance ≥3 CLSI Classes[1]	3.1%	0.4%	0.2%	0.0%	0.8%	0.8%	0.4%	0.5%	0.0%	0.0%	21.8%	0.0%	0.0%	0.6%
	4	2	1	0	4	3	2	3	0	0	0	0	0	2
Resistance ≥4 CLSI Classes[1]	2.3%	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%
	3	0	0	0	0	1	0	0	0	0	0	0	0	0
Resistance ≥5 CLSI Classes[1]	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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

Please Note: An error was found in the software used to calculate MDR thus several values for previous years have been updated.

C. *Escherichia coli*

Table 1C. Number of *E. coli* Tested from Chickens, 2000-2011

Year											
2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
285	1989	2100	1365	1697	2232	1357	1510	986	877	941	614

Table 2C. Distribution of MICs and Occurrence of Resistance among *E. coli* from Chickens, 2011

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																				
Gentamicin	6.2	**42.8**	38.9-46.8					4.7	30.0	13.7	1.5	1.1	6.2	**20.0**	**22.8**					
Kanamycin	0.5	**5.7**	4.1-7.9										90.7	3.1	0.5	**0.2**	**5.5**			
Streptomycin	N/A	**50.8**	46.8-54.8												49.2	**20.4**	**30.5**			
β-Lactam/β-Lactamase Inhibitor Combinations																				
Amoxicillin-Clavulanic Acid	0.7	**9.4**	7.3-12.1							4.9	30.8	46.6	7.7	0.7	**8.5**	**1.0**				
Cephems																				
Cefoxitin	0.7	**9.1**	7.0-11.7							1.1	29.2	48.9	11.1	0.7	**4.7**	**4.4**				
Ceftiofur	2.4	**6.8**	5.0-9.2				2.1	47.6	39.6	1.0	0.5	2.4	**4.9**	**2.0**						
Ceftriaxone	0.3	**9.3**	7.2-11.9					89.9	0.5		0.3	**0.7**	**5.7**	**2.4**	**0.3**	**0.2**				
Macrolides																				
Azithromycin	N/A	**0.2**	0-1.1							1.3	28.5	61.7	7.8	0.5	**0.2**					
Folate Pathway Inhibitors																				
Sulfonamides	N/A	**54.7**	50.7-58.7											35.8	9.0	0.5			**54.7**	
Trimethoprim-Sulfamethoxazole	N/A	**4.2**	2.8-6.2				76.9	10.4	3.9	3.9	0.7	**0.2**	**4.1**							
Penicillins																				
Ampicillin	0.2	**16.0**	13.2-19.2							13.4	51.5	18.6	0.3	0.2	**0.5**	**15.5**				
Phenicols																				
Chloramphenicol	0.3	**2.1**	1.2-3.7								7.3	63.0	27.2	0.3		**2.1**				
Quinolones																				
Ciprofloxacin	0.0	**0.3**	0-1.3	96.1	1.6		1.0	1.0					**0.3**							
Nalidixic Acid	N/A	**2.3**	1.3-3.9						1.5	32.9	58.3	5.0			**0.8**	**1.5**				
Tetracyclines																				
Tetracycline	1.1	**46.6**	42.6-50.6									52.3	1.1	**2.4**	**11.1**	**33.1**				

[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 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, 2000-2011

Year		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Number of Isolates Tested		285	1989	2100	1365	1697	2232	1357	1510	986	877	941	614
Antimicrobial Class	Antimicrobial (Resistance Breakpoint)												
Aminoglycosides	Gentamicin	40.0%	33.4%	38.0%	38.8%	39.1%	36.7%	33.1%	38.0%	44.5%	43.3%	43.0%	42.8%
		114	664	799	530	663	819	449	574	439	380	405	263
	Kanamycin	16.1%	14.5%	11.6%	10.3%	11.5%	10.3%	9.1%	7.7%	10.2%	7.9%	6.4%	5.7%
		46	288	243	140	196	231	123	117	101	69	60	35
	Streptomycin	77.5%	65.8%	65.1%	64.2%	64.1%	58.0%	49.5%	47.0%	54.6%	49.8%	49.1%	50.8%
		221	1308	1368	877	1088	1295	672	710	538	437	462	312
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%	9.4%
		23	199	229	151	149	236	217	169	135	109	117	58
Cephems	Cefoxitin	7.4%	8.7%	8.5%	8.3%	8.2%	9.9%	15.0%	10.3%	13.8%	11.4%	12.5%	9.1%
		21	173	178	113	139	221	204	155	136	100	118	56
	Ceftriaxone	6.3%	7.6%	8.6%	9.4%	7.2%	9.0%	14.7%	10.3%	13.5%	11.5%	12.3%	9.3%
		18	152	181	128	122	200	199	155	133	101	116	57
	Cephalothin	17.9%	12.9%	15.1%	16.6%	Not Tested	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%	6.8%
		18	88	115	97	83	145	139	106	103	83	94	42
Macrolides	Azithromycin	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	0.2%
													1
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%	54.7%
		165	1157	969	599	903	1159	660	804	520	461	487	336
	Trimethoprim-Sulfamethoxazole	17.2%	12.6%	10.4%	10.5%	10.7%	10.4%	8.4%	7.9%	9.1%	7.0%	6.4%	4.2%
		49	251	218	144	181	232	114	120	90	61	60	26
Penicillins	Ampicillin	20.0%	19.5%	19.0%	18.6%	17.6%	22.0%	25.6%	18.7%	23.5%	19.8%	22.2%	16.0%
		57	388	399	254	298	492	347	282	232	174	209	98
Phenicols	Chloramphenicol	4.6%	2.4%	1.8%	1.3%	1.0%	1.0%	1.9%	2.3%	1.0%	1.1%	0.7%	2.1%
		13	47	38	18	17	22	26	34	10	10	7	13
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	3	0	1	3	8	0	1	6	4	2	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%	2.3%
		29	168	142	84	115	168	73	64	59	28	32	14
Tetracyclines	Tetracycline	68.4%	61.6%	58.6%	52.2%	50.3%	48.9%	49.0%	40.2%	47.4%	49.1%	42.9%	46.6%
		195	1226	1231	713	853	1092	665	607	467	431	404	286

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

Table 4C. MDR *E. coli* from Chickens, 2000-2011

Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Number of Isolates Tested	285	1989	2100	1365	1697	2232	1357	1510	986	877	941	614
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%	21.5%
	29	257	333	219	288	395	252	367	206	192	202	132
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%	78.5%
	256	1732	1767	1146	1409	1837	1105	1143	780	685	739	482
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%	63.4%
	219	1419	1430	887	1129	1444	854	920	645	572	600	389
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%	37.3%
	157	1000	921	535	729	926	593	554	435	363	360	229
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%	11.7%
	55	320	300	188	200	333	237	206	164	127	142	72
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%	6.5%
	23	162	155	98	98	170	121	107	89	66	77	40

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

D. Enterococcus

Table 1D. Number of *Enterococcus* Isolates Tested from Chickens, 2003-2011

Animal Source	**Year**								
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Chickens	2043	2456	3035	2120	1571	916	832	948	524

Table 2D. *Enterococcus* Species Tested from Chickens, 2011

Species	**n**	**%**
Faecalis	275	52.5
Faecium	128	24.4
Hirae	39	7.4
Durans	26	5.0
Casseliflavus	20	3.8
Gallinarum	12	2.3
Enterococcus spp.	11	2.1
Avium	6	0.9
Gilvus	2	0.4
Cecorum	1	0.2
Dispar	1	0.2
Malodoratus	1	0.2
Pseudoavium	1	0.2
Saccharolyticus	1	0.2
Total	**524**	**100.0**

Figure 1D. *Enterococcus* Species Percent Distribution by Year in Relation to Top Species Identified in 2011

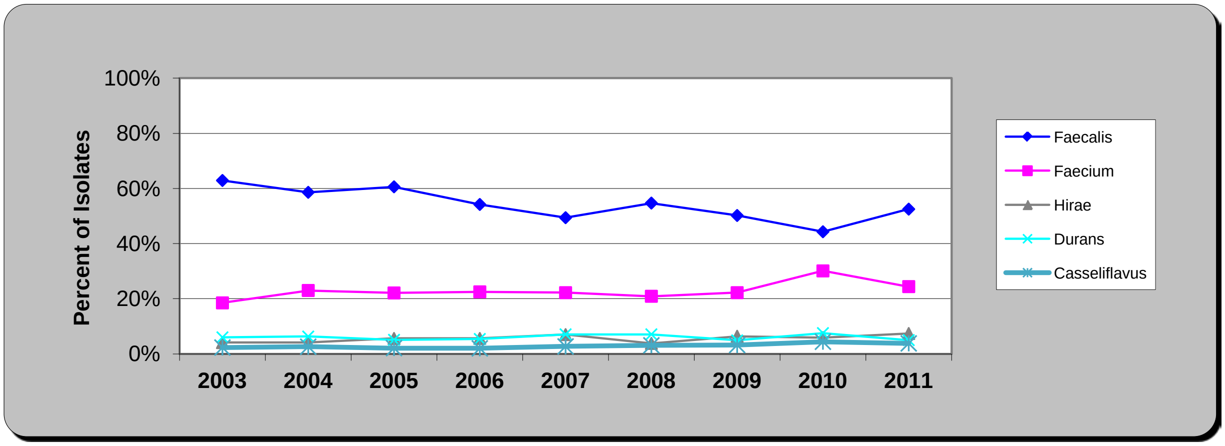


Table 3D. Distribution of MICs and Occurrence of Resistance among *Enterococcus* from Chickens, 2011

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	**28.1**	24.3-32.2														69.7	2.3	**1.0**	**4.2**	**22.9**	
Kanamycin	N/A	**34.5**	30.5-38.8														57.1	5.7	2.7	**1.9**	**32.6**	
Streptomycin	N/A	**19.3**	16.1-23.0																80.7	**5.3**	**4.2**	**9.7**
Glycopeptide																						
Vancomycin	1.5	**0.0**	0.0-0.9					0.4	21.6	40.8	30.2	5.5	1.5									
Glycylcycline																						
Tigecycline	N/A	**0.2**	0-1.2	0.2	2.3	40.1	46.9	10.3	**0.2**													
Lincosamides																						
Lincomycin	1.5	**96.4**	94.3-97.8							1.7	0.4	1.5	**0.8**	**95.6**								
Lipopeptides																						
Daptomycin	N/A	**0.6**	0.2-1.8					4.8	10.5	39.7	29.8	14.7	**0.6**									
Macrolides																						
Erythromycin	31.9	**33.8**	29.8-38.1					28.8	5.5	17.0	12.2	2.7	**2.7**	**31.1**								
Tylosin	1.5	**32.3**	28.3-36.5					0.2	0.2	9.4	38.7	12.4	5.3	1.5	**0.4**	**31.9**						
Nitrofuran																						
Nitrofurantoin	17.0	**18.7**	15.5-22.4								0.4	0.8	26.7	27.5	9.0	17.0	**18.7**					
Oxazolidinone																						
Linezolid	0.0	**0.0**	0.0-0.9						0.4	51.7	47.9											
Penicillin																						
Penicillin	0	**7.4**	5.4-10.1					7.1	4.0	5.3	23.7	44.1	8.4	**4.6**	**2.9**							
Phenicol																						
Chloramphenicol	1.1	**0.4**	0.1-1.6								0.4	26.1	71.9	1.1		**0.4**						
Quinolone																						
Ciprofloxacin	20.8	**12.6**	9.9-15.8				0.2	6.5	9.0	51.0	20.8	**11.6**	**1.0**									
Streptogramin																						
Quinupristin/Dalfopristin[5]	38.2	**47.4**	41.1-53.8						4.8	9.6	38.2	**12.4**	**22.1**	**9.2**	**3.6**							
Tetracyclines																						
Tetracycline	1.5	**75.6**	71.6-79.2							20.4	1.0	1.5	1.5	**1.5**	**7.6**	**66.4**						

[1] Percent of isolates with intermediate susceptibility

[2] Percent of isolates that were resistant

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

[4] The unshaded areas indicate the range of dilutions tested for each antimicrobial. Single vertical bars indicate the breakpoints for susceptibility, while double vertical bars indicate the breakpoints for resistance. Numbers in the shaded 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* (n=275 in 2011) excluded from Quinuspristin/Dalfopristin results

Table 4D. Antimicrobial Resistance among *Enterococcus* from Chickens, 2003-2011

Year		**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Number of Isolates Tested		2043	2456	3035	2120	1571	916	832	948	524
Antimicrobial Class	**Antimicrobial**									
Aminoglycosides	Gentamicin	463	547	647	441	360	255	205	245	147
		22.7%	22.3%	21.3%	20.8%	22.9%	27.8%	24.6%	25.8%	28.1%
	Kanamycin	666	752	950	620	487	340	232	283	181
		32.6%	30.6%	31.3%	29.2%	31.0%	37.1%	27.9%	29.9%	34.5%
	Streptomycin	403	419	658	330	199	136	134	187	101
		19.7%	17.1%	21.7%	15.6%	12.7%	14.8%	16.1%	19.7%	19.3%
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%	0.0%	0.0%
Glycylcycline	Tigecycline	Not	Not	Not	3	13	3	7	0	1
		Tested	Tested	Tested	0.1%	0.8%	0.3%	0.8%	0.0%	0.2%
Lincosamides	Lincomycin	1995	2330	2911	1983	1473	861	772	902	505
		97.7%	94.9%	95.9%	93.5%	93.8%	94.0%	92.8%	95.1%	96.4%
Lipopeptide	Daptomycin	Not	40	21	3	4	1	6	6	3
		Tested	1.6%	0.7%	0.1%	0.3%	0.1%	0.7%	0.6%	0.6%
Macrolide	Erythromycin	748	833	1075	841	544	367	290	320	177
		36.6%	33.9%	35.4%	39.7%	34.6%	40.1%	34.9%	33.8%	33.8%
	Tylosin	754	834	1071	840	511	365	284	315	169
		36.9%	34.0%	35.3%	39.6%	32.5%	39.8%	34.1%	33.2%	32.3%
Nitrofurans	Nitrofurantoin	294	493	525	379	284	165	135	218	98
		14.4%	20.1%	17.3%	17.9%	18.1%	18.0%	16.2%	23.0%	18.7%
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%	0.0%	0.0%
Penicillins	Penicillin	172	205	253	147	135	76	69	88	39
		8.4%	8.3%	8.3%	6.9%	8.6%	8.3%	8.3%	9.3%	7.4%
Phenicols	Chloramphenicol	4	2	3	6	6	3	2	0	2
		0.2%	0.1%	0.1%	0.3%	0.4%	0.3%	0.2%	0.0%	0.4%
Quinolones	Ciprofloxacin	96	243	222	188	113	92	82	106	66
		4.7%	9.9%	7.3%	8.9%	7.2%	10.0%	9.9%	11.2%	12.6%
Streptogramins	Quinupristin/	284	314	374	349	202	111	151	171	118
	Dalfopristin[1]	37.5%	30.9%	31.3%	36.0%	25.4%	26.7%	36.5%	32.4%	47.4%
Tetracyclines	Tetracycline	1462	1771	2129	1580	1095	677	613	693	396
		71.6%	72.1%	70.1%	74.5%	69.7%	73.9%	73.7%	73.1%	75.6%

[1] *E. faecalis* (n=275 in 2011) excluded from Quinuspristin/Dalfopristin results

Table 5D. Distribution of MICs and Occurrence of Resistance for Top *Enterococcus* Species Tested from Chickens, 2011

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(275)	0.0	**36.7**	31.0-42.7														61.5	1.8	**1.1**	**5.8**	**29.8**	
	Faecium(128)	0.0	**14.1**	8.8-21.6														82.8	3.1		**1.6**	**12.5**	
	Hirae(39)	0.0	**17.9**	8.1-34.1														79.5	2.6			**17.9**	
	Durans(26)	0.0	**7.7**	1.3-26.6														92.3		**3.8**		**3.8**	
	Casseliflavus(20)	0.0	**45.0**	23.8-68.0														55.0			**5.0**	**40.0**	
	Gallinarum(12)	0.0	**58.3**	28.6-83.5														41.7		**8.3**	**25.0**	**25.0**	
Kanamycin	Faecalis(275)	N/A	**43.3**	37.4-49.4														54.2	2.2	0.4	**2.2**	**41.1**	
	Faecium(128)	N/A	**21.1**	14.6-29.4														57.0	15.6	6.2	**1.6**	**19.5**	
	Hirae(39)	N/A	**23.1**	11.7-39.7														69.2	7.7		**2.6**	**20.5**	
	Durans(26)	N/A	**7.7**	1.3-26.6														88.5		3.8		**7.7**	
	Casseliflavus(20)	N/A	**55.0**	32.0-76.2														30.0	5.0	10.0	**5.0**	**50.0**	
	Gallinarum(12)	N/A	**66.7**	35.5-88.7														33.3				**66.7**	
Streptomycin	Faecalis(275)	N/A	**21.8**	17.2-27.2																78.2	**2.5**	**4.7**	**14.5**
	Faecium(128)	N/A	**23.4**	16.6-31.9																76.6	**14.1**	**6.2**	**3.1**
	Hirae(39)	N/A	**2.6**	0.1-15.1																97.4	**2.6**		
	Durans(26)	N/A	**0.0**	0.0-16.0																100.0			
	Casseliflavus(20)	N/A	**30.0**	12.8-54.3																70.0	**5.0**		**25.0**
	Gallinarum(12)	N/A	**16.7**	3.0-49.2																83.3		**8.3**	**8.3**
Glycopeptide																							
Vancomycin	Faecalis(275)	0.4	**0.0**	0.0-1.7					0.4	1.5	50.9	40.7	6.2	0.4									
	Faecium(128)	0.0	**0.0**	0.0-3.6						53.9	24.2	21.1	0.8										
	Hirae(39)	0.0	**0.0**	0.0-11.2						15.4	71.8	7.7	5.1										
	Durans(26)	0.0	**0.0**	0.0-16.0					3.8	80.8	7.7	7.7											
	Casseliflavus(20)	5.0	**0.0**	0.0-20.0						10.0	15.0	55.0	15.0	5.0									
	Gallinarum(12)	50.0	**0.0**	0.0-30.1									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, 2011

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(275)	N/A	**0.0**	**0.0-1.7**		0.4	28.0	58.5	13.1														
	Faecium(128)	N/A	**0.0**	**0.0-3.6**		1.6	57.0	32.0	9.4														
	Hirae(39)	N/A	**0.0**	**0.0-11.2**		15.4	61.5	17.9	5.1														
	Durans(26)	N/A	**0.0**	**0.0-16.0**			61.5	38.5															
	Casseliflavus(20)	N/A	**0.0**	**0.0-20.0**			40.0	55.0	5.0														
	Gallinarum(12)	N/A	**0.0**	**0.0-30.1**			50.0	41.7	8.3														
Lincosamides																							
Lincomycin	Faecalis(275)	0.0	**99.6**	97.6-100								0.4		**0.4**	**99.3**								
	Faecium(128)	0.0	**93.0**	86.7-96.6							7.0			**2.3**	**90.6**								
	Hirae(39)	0.0	**100.0**	88.8-100											**100.0**								
	Durans(26)	0.0	**100.0**	84.0-100											**100.0**								
	Casseliflavus(20)	0.0	**100.0**	80.0-100											**100.0**								
	Gallinarum(12)	0.0	**100.0**	69.9-100											**100.0**								
Lipopeptides																							
Daptomycin	Faecalis(275)	N/A	**0.0**	0.0-1.7					0.4	8.7	62.2	26.5	2.2										
	Faecium(128)	N/A	**1.6**	0.3-6.2					0.8		7.0	38.3	52.3	**1.6**									
	Hirae(39)	N/A	**2.6**	0.1-15.1						5.1	30.8	56.4	5.1	**2.6**									
	Durans(26)	N/A	**0.0**	0.0-16.0					30.8	42.3	19.2	7.7											
	Casseliflavus(20)	N/A	**0.0**	0.0-20.0					10.0	55.0	10.0	15.0	10.0										
	Gallinarum(12)	N/A	**0.0**	0.0-30.1						8.3	41.7	50.0											
Macrolides																							
Erythromycin	Faecalis(275)	37.8	**39.6**	33.8-45.7					18.5	4.0	22.2	12.7	2.9	**1.5**	**38.2**								
	Faecium(128)	40.6	**24.2**	17.3-32.7					29.7	5.5	14.1	22.7	3.9	**2.3**	**21.9**								
	Hirae(39)	2.6	**17.9**	8.1-34.1					79.5		2.6			**2.6**	**15.4**								
	Durans(26)	0.0	**42.3**	24.0-62.8					53.8	3.8				**11.5**	**30.8**								
	Casseliflavus(20)	40.0	**40.0**	20.0-63.6					5.0	15.0	35.0		5.0		**40.0**								
	Gallinarum(12)	0.0	**33.3**	11.3-64.5					16.7	50.0				**16.7**	**16.7**								
Tylosin	Faecalis(275)	1.1	**39.6**	33.8-45.7					0.4		6.5	49.5	1.8	1.1	1.1		**39.6**						
	Faecium(128)	1.6	**21.9**	15.3-30.2							7.0	18.8	34.4	16.4	1.6	**0.8**	**21.1**						
	Hirae(39)	5.1	**12.8**	4.8-28.2								66.7	15.4		5.1		**12.8**						
	Durans(26)	0.0	**38.5**	20.9-59.3						3.8	26.9	11.5	15.4	3.8		**3.8**	**34.6**						
	Casseliflavus(20)	0.0	**40.0**	20.0-63.6							15.0	45.0					**40.0**						
	Gallinarum(12)	0.0	**25.0**	6.7-57.2							58.3	16.7					**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, 2011

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(275)	4.4	**3.3**	1.6-6.4										45.1	42.2	5.1	4.4	**3.3**					
	Faecium(128)	47.7	**44.5**	35.8-53.5										2.3	3.9	1.6	47.7	**44.5**					
	Hirae(39)	33.3	**5.1**	0.9-18.6											2.6	59.0	33.3	**5.1**					
	Durans(26)	7.7	**92.3**	73.4-98.7													7.7	**92.3**					
	Casseliflavus(20)	0.0	**10.0**	1.8-33.1										25.0	45.0	20.0		**10.0**					
	Gallinarum(12)	0.0	**0.0**	0.0-30.1									25.0	58.3	16.7								
Oxazolidinone																							
Linezolid	Faecalis(275)	0.0	**0.0**	0.0-1.7							49.8	50.2											
	Faecium(128)	0.0	**0.0**	0.0-3.6							38.3	61.7											
	Hirae(39)	0.0	**0.0**	0.0-11.2							56.4	43.6											
	Durans(26)	0.0	**0.0**	0.0-16.0							84.6	15.4											
	Casseliflavus(20)	0.0	**0.0**	0.0-20.0							60.0	40.0											
	Gallinarum(12)	0.0	**0.0**	0.0-30.1							100.0												
Penicillin																							
Penicillin	Faecalis(275)	N/A	**1.5**	0.5-4.0					0.7	0.4	2.2	31.6	60.7	2.9	**1.1**	**0.4**							
	Faecium(128)	N/A	**24.2**	17.3-32.7					3.9	3.9	3.1	10.9	37.5	16.4	**14.8**	**9.4**							
	Hirae(39)	N/A	**2.6**	0.1-15.1					28.2		17.9	33.3	15.4	2.6		**2.6**							
	Durans(26)	N/A	**7.7**	1.3-26.6					26.9	7.7	3.8		11.5	42.3	**3.8**	**3.8**							
	Casseliflavus(20)	N/A	**0.0**	0.0-20.0					5.0	50.0	20.0	10.0	10.0	5.0									
	Gallinarum(12)	N/A	**0.0**	0.0-30.1							33.3	33.3	16.7	16.7									
Phenicol	Faecalis(275)	1.8	**0.7**	0.1-2.8									4.4	93.1	1.8		**0.7**						
Chloramphenicol	Faecium(128)	0.8	**0.0**	0.0-3.6									35.2	64.1	0.8								
	Hirae(39)	0.0	**0.0**	0.0-11.2									92.3	7.7									
	Durans(26)	0.0	**0.0**	0.0-16.0									53.8	46.2									
	Casseliflavus(20)	0.0	**0.0**	0.0-20.0									40.0	60.0									
	Gallinarum(12)	0.0	**0.0**	0.0-30.1									91.7	8.3									

[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, 2011

	Species				**Distribution (%) of MICs (µg/ml)**[4]																		
Antimicrobial	**(# 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**	**2048**	**4096**
Quinolone																							
Ciprofloxacin	Faecalis(275)	17.1	**1.8**	0.7-4.4				0.4	0.7	2.9	77.1	17.1	**1.8**										
	Faecium(128)	35.9	**46.1**	37.3-55.1						2.3	15.6	35.9	**42.2**	**3.9**									
	Hirae(39)	0.0	**0.0**	0.0-11.2					48.7	30.8	20.5												
	Durans(26)	7.7	**0.0**	0.0-16.0					42.3	46.2	3.8	7.7											
	Casseliflavus(20)	40.0	**10.0**	1.8-33.1							50.0	40.0	**10.0**										
	Gallinarum(12)	33.3	**0.0**	0.0-30.1							66.7	33.3											
Streptogramin																							
Quinupristin/Dalfopristin	Faecalis(275)	N/A	**N/A**	N/A																			
	Faecium(128)	25.0	**64.1**	55.1-72.2						5.5	5.5	25.0	**12.5**	**26.6**	**18.0**	**7.0**							
	Hirae(39)	51.3	**48.7**	32.7-65.0								51.3	**5.1**	**43.6**									
	Durans(26)	69.2	**15.4**	5.1-35.7						3.8	11.5	69.2	**11.5**	**3.8**									
	Casseliflavus(20)	70.0	**25.0**	9.6-49.4							5.0	70.0	**20.0**	**5.0**									
	Gallinarum(12)	66.7	**25.0**	6.7-57.2							8.3	66.7	**25.0**										
Tetracvclines																							
Tetracycline	Faecalis(275)	1.1	**78.5**	73.1-83.1							18.5	1.5	0.4	1.1	**0.7**	**10.9**	**66.9**						
	Faecium(128)	3.9	**73.4**	64.7-80.6							19.5		3.1	3.9	**3.9**	**2.3**	**67.2**						
	Hirae(39)	0.0	**64.1**	47.2-78.3							30.8	2.6	2.6				**64.1**						
	Durans(26)	0.0	**76.9**	55.9-90.2							19.2		3.8				**76.9**						
	Casseliflavus(20)	0.0	**80.0**	55.7-93.4							20.0					**10.0**	**70.0**						
	Gallinarum(12)	0.0	**91.7**	59.8-99.6							8.3					**8.3**	**83.3**						

[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, 2003-2011

	E. faecalis								
Year	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Number of Isolates Tested	1285	1440	1839	1150	776	501	418	420	275
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	0.0% 0
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	100.0% 275
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	85.1% 234
Resistance >3 CLSI Classess[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	59.3% 163
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	27.6% 76
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	3.3% 9

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

Table 7D. MDR *Enterococcus faecium* from Chickens, 2003-2011

	E. faecium								
Year	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Number of Isolates Tested	377	564	670	477	349	191	185	285	128
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	0.8% 1
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	99.2% 127
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	91.4% 117
Resistance >3 CLSI Classess[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	80.5% 103
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	69.5% 89
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	45.3% 58

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