1999 Annual Report

NARMS

National Antimicrobial Resistance Monitoring System: Enteric Bacteria

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

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* Information on animal isolates is available at
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Page Number		Tables

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

1999 Annual Report

Summary

In 1999, 1499 non-Typhi *Salmonella* isolates**,** 166 *Salmonella* Typhi isolates, 375 *Shigella,* 292 *E. coli* O157 isolates, and 319 *Campylobacter* isolates from humans were tested by the National Antimicrobial Resistance Monitoring System (NARMS) for Enteric Bacteria. Twenty-six percent of non-Typhi *Salmonella* isolates were resistant to one or more antimicrobial agents. Among *Salmonella* serotype Typhimurium isolates, 49% were resistant to one or more antimicrobial agents. Twenty-eight percent of *Salmonella* Typhimurium isolates had the multidrug-resistant pattern characteristic of DT104; resistant to ampicillin, chloramphenicol, streptomycin, sulfamethoxazole, and tetracycline (ACSSuT). One *Salmonella* isolate was resistant to ciprofloxacin (*S.* Senftenberg). The percentage of non-Typhi *Salmonella* isolates with ciprofloxacin minimum inhibitory concentrations (MICs) $\geq$0.25 µg/ml increased from 0.4% in 1996 to 1.0% in 1999. The percentage of non-Typhi *Salmonella* isolates with a ceftriaxone MIC $\geq$ 16 µg/ml increased from 0.1% in 1996 to 2% in 1999. Among *S.* Typhi isolates, 29% were resistant to one or more antimicrobial agents. Among *Shigella* isolates, 91% were resistant to one or more antimicrobial agents. Among *E. coli* O157 isolates, 10% were resistant to one or more antimicrobial agents. Among all *Campylobacter* isolates, 53% were resistant to one or more antimicrobial agents. Among *Campylobacter jejuni* isolates, 54% were resistant to one or more antimicrobial agents; 18% were resistant to ciprofloxacin.

Methods

NARMS was launched in 1996, within the framework of CDC's Emerging Infections Program's Epidemiology and Laboratory Capacity Program and the Foodborne Disease Active Surveillance Network (FoodNet) as a collaboration among CDC, the U.S. Food and Drug Administration (FDA)-Center for Veterinary Medicine, U. S. Department of Agriculture (USDA)-Food Safety and Inspection Service and Agricultural Research Service, and state and local health departments to monitor prospectively the antimicrobial resistance of human non-Typhi *Salmonella* and *Escherichia coli* O157 isolates. Testing of *Campylobacter* isolates was added in 1997, and testing of *Salmonella* Typhi and *Shigella* isolates was added in 1999. In 1999, there were 17 NARMS health department participants (CA, CO, CT, FL, GA, KS, Los Angeles County, MD, MN, MA, NJ, New York City, NY, OR, TN, WA, and WV), representing approximately 103 million persons (38% of the United States population), and 7 of the 9 U.S. regions [Table 1]. In 1999, seven states (CA, CT, GA, MD, MN, NY, and OR) also monitored antimicrobial resistance among human *Campylobacter* isolates.

In 1999, NARMS participating public health laboratories have selected every tenth non-Typhi *Salmonella,* every *Salmonella* Typhi, every tenth *Shigella*, and every fifth *E. coli* O157 isolate received at their laboratory, and forwarded the isolates to CDC for susceptibility testing. Although we requested that participating laboratories send every *S.* Typhi isolate, analysis was restricted to one isolate per patient. At CDC, a semiautomated system (Sensititre, Trek Diagnostics, Westlake, OH) is used to determine the MICs for 17 antimicrobial agents: amikacin, ampicillin, amoxicillin-clavulanic acid, apramycin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, florfenicol, gentamicin, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, and trimethoprim-sulfamethoxazole [Table 2].

Public health laboratories from eight states also select and forward the first *Campylobacter* isolate received each week to CDC for susceptibility testing. For *Campylobacter*, the E-test system (AB BIODISK, Solna, Sweden) is used to determine the MICs for 8 antimicrobial agents: azithromycin, chloramphenicol, ciprofloxacin, clindamycin, erythromycin, gentamicin, nalidixic acid, and tetracycline [Table 2]. After confirmation to genus level, identification of *Campylobacter* to species level is performed using the hippurate test, and, for hippurate-negative *Campylobacter* isolates, and polymerase chain reaction to identify the hippuricase gene, diagnostic of *Campylobacter jejuni*.

For all pathogens in this report, MIC results are dichotomized: isolates with intermediate susceptibility are categorized as sensitive. Breakpoints are determined using, when available, National Committee for Clinical Laboratory Standards (NCCLS) [Table 2].

Results

Non-Typhi *Salmonella*

A total of 1514 non-Typhi *Salmonella* isolates were received at CDC in 1999; 1499/1514 (99%) were viable upon receipt and tested for antimicrobial susceptibility [Table 4a, Figure 1]. Non-Typhi *Salmonella* refers to all *Salmonella* serotypes except serotype Typhi. The antimicrobial agents to which *Salmonella* demonstrated the highest prevalence of resistance were tetracycline, sulfamethoxazole, streptomycin, and ampicillin: 292/1499 (19%) were resistant to tetracycline, 272/1499 (18%) isolates were resistant to sulfamethoxazole, 254/1499 (17%) were resistant to streptomycin, and 234/1499 (16%) were resistant to ampicillin [Figure 2]. Figure 3 provides MIC results for each of the 17 antimicrobials tested. One (0.1%) isolate (*S.* serotype Senftenberg) was resistant to ciprofloxacin; 16 (1%) isolates were resistant to nalidixic acid. Six (0.4%) isolates were resistant to ceftriaxone.

Among non-Typhi *Salmonella* isolates, 388/1499 (26%) were resistant to one or more agents, and 315/1499 (21%) were resistant to two or more agents*.* Among *Salmonella* isolates tested, 269/1499 (18%) were serotype Enteritidis and 362/1499 (24%) were serotype Typhimurium (includes serotype Typhimurium var. Copenhagen) [Table 5]. In 1999, the serotypes with the highest proportion of isolates which were pansusceptible were Javiana (98%), Thompson (97%), and Braenderup (96%) [Table 6]. Figure 4 provides the resistance among non-Typhi *Salmonella* serotypes from 1996-1999. Among *S.* Enteritidis isolates, 44/269 (16%) were resistant to one or more antimicrobial agents*.* Among *S.* Typhimurium isolates, 179/362 (49%) were resistant to one or more antimicrobial agents [Table 7]*.* Figure 5 provides the percent of *S*. Typhimurium by site.

In recent years, a multidrug-resistant strain of *S.* Typhimurium has been identified. This strain is characterized not only by the multidrug-resistant pattern, but also by the phage type – DT104 [Table 8]. Although none of 362 *S.* Typhimurium isolates tested were phage typed, 102 (28%) were resistant to the five antimicrobial agents, ampicillin, chloramphenicol, streptomycin, sulfamethoxazole, and tetracycline (ACSSuT), to which *S.* Typhimurium DT104 is commonly resistant [Figure 6]. Of the 102 *S.* Typhimurium isolates with the ACSSuT resistance pattern, 12 (12%) were also resistant to kanamycin, 9 (9%) were also resistant to cephalothin, 7 (7%) were also resistant to amoxicillin-clavulanic acid, 3 (3%) were also resistant to ceftiofur, and 1 (1%) was also resistant to ceftriaxone [Table 9].

A second penta-resistant pattern, resistance to ampicillin, kanamycin, streptomycin, sulfamethoxazole, and tetracycline (AKSSuT), also has emerged among *Salmonella* Typhimurium [Table 8]. Strains with this resistance pattern are not DT104 by phage typing. Among 362 *Salmonella* Typhimurium isolates tested, 39/362 (11%) had the AKSSuT resistance pattern [Figure 7]. Of the 39 *S.* Typhimurium isolates with the AKSSuT resistance pattern, 12 (31%) were also resistant to chloramphenicol, 8 (20%) were also resistant to cephalothin, and 2 (5%) were also resistant to amoxicillin-clavulanic acid [Table 9]. Table 10 describes the clinical source of all non-Typhi isolates tested in 1999.

One *Salmonella* isolate (0.1%) was resistant to ciprofloxacin [Figure 3i]. The percentage of *Salmonella* isolates with ciprofloxacin MICs $\geq$0.25 increased from 0.4% (5/1326) in 1996 to 1% (15/1499) in 1999 [Table 11]. The percentage of *Salmonella* isolates resistant to nalidixic acid (MIC $\geq$32) increased from 0.4% (5/1326) in 1996 to 1% (16/1499) in 1999 [Figure 3m]. The percentage of *Salmonella* isolates with decreased susceptibility to ceftriaxone (MIC $\geq$16) increased from 0.1% (1/1326) in 1996 to 2% (28/1499) in 1999 [Table 12, Figure 3f]. Seventeen of the 97 (18%) *S*. Newport isolates were highly multidrug-resistant, resistant to amoxicillin-clavulanic acid, ampicillin, ceftiofur, cephalothin, chloramphenicol, streptomycin, sulfamethoxazole, and tetracycline as well as having decreased susceptibility to ceftriaxone [Figure 4j].

Salmonella Typhi

A total of 249 *S.* Typhi isolates were received at CDC in 1999; 207/249 (83%) were viable upon receipt and tested for antimicrobial sensitivity [Table 4b, Figure 1]. Of these 207 isolates, forty-one *S*. Typhi isolates were eliminated from analysis because they were duplicate submissions. Among *S.* Typhi isolates, 49/166 (29%) were resistant to one or more antimicrobial agents and 25/166 (15%) were resistant to two or more agents. The most common resistances among *S.* Typhi isolates were to nalidixic acid 31/166 (19%), sulfamethoxazole 28/166 (17%), or streptomycin 23/166 (14%) [Table 3, Figure 8]. Twenty-one (13%) isolates were resistant to ampicillin; 20 (12%) isolates were resistant to chloramphenicol. Figure 9 provides data on *Salmonella* Typhi MICs by antimicrobial agent. None of the *S.* Typhi isolates tested were resistant to amikacin, apramycin, ciprofloxacin, florfenicol, gentamicin, or kanamycin.

Shigella

A total of 377 *Shigella* isolates were received at CDC in 1999; 375/377 (99%) were viable upon receipt and tested for antimicrobial sensitivity [Table 4c, Figure 1]. Among *Shigella* isolates, 341/375 (91%) were resistant to one or more antimicrobial agents and 244/375 (65%) were resistant to two or more agents. The most common resistances among all *Shigella* isolates were to ampicillin 288/375 (77%), tetracycline 215/375 (57%), streptomycin 209/375 (56%), or sulfamethoxazole 206/375 (55%) [Table 3, Figure 10]. One hundred ninety-three (51%) isolates were resistant to trimethoprim-sulfamethoxazole. *Shigella sonnei* isolates were most frequently resistant to ampicillin 219/275 (80%), sulfamethoxazole 150/275 (54%), or streptomycin 143/275 (52%) [Figure 11]. Figure 12 provides data on *Shigella sonnei* MICs by antimicrobial agent. The most common resistances among *Shigella flexneri* isolates were to tetracycline 80/87 (92%), ampicillin 67/87 (77%), or chloramphenicol 56/87 (64%) [Figure 11]. Figure 13 provides data on *Shigella flexneri* MICs by antimicrobial agent. None of the *Shigella* isolates tested were resistant to amikacin, apramycin, ceftiofur, ceftriaxone, ciprofloxacin, or florfenicol.

***E. coli* O157**

A total of 296 *E. coli* O157 isolates were received at CDC in 1999; 292/296 (99%) were viable upon receipt and tested for antimicrobial sensitivity [Table 4d, Figure 1]. Among *E. coli* O157 isolates, 30/292 (10%) were resistant to one or more antimicrobial agents and 12/292 (4%) were resistant to two or more agents. The most common resistances among *E. coli* O157 isolates were to sulfamethoxazole 24/292 (8%), tetracycline 10/292 (3%), and streptomycin 8/292 (3%) [Table 3, Figure 14]. Figure 15 provides data on *E. coli* O157 MICs by antimicrobial agent. None of the *E. coli* O157 isolates tested were resistant to amikacin, apramycin, ceftiofur, ceftriaxone, chloramphenicol, ciprofloxacin, or florfenicol.

Campylobacter

A total of 393 *Campylobacter* isolates were collected in 1999 and forwarded to CDC; 319/398 (80%) were viable upon receipt and tested for antimicrobial susceptibility [Table 4e, Figure 1]. Of the isolates tested, 295/319 (92%) were *C. jejuni*, 20/319 (6%) were *C. coli*, 2 were *C. upsaliensis*, and 2 were *C. fetus* [Table 15].

Among *Campylobacter jejuni* isolates, 158/295 (54%) were resistant to one or more antimicrobial agents, and 60/295 (20%) were resistant to two or more agents. The most common resistances among *Campylobacter jejuni* isolates was to tetracycline 135/295 (46%) followed by nalidixic acid 59/295 (20%), and ciprofloxacin 52/295 (18%) [Table 16, Figure 17a]. Figure 18 provides data on *C. jejuni* MICs by antimicrobial agent.

Among *Campylobacter coli* isolates, 10/20 (50%) were resistant to one or more antimicrobial agents, and 7/20 (35%) were resistant to two or more agents. The most common resistances among *C. coli* isolates was to nalidixic acid 6/20 (30%), tetracycline 6/20 (30%), or ciprofloxacin 6/20 (30%) [Table 16, Figure 17b]. Figure 19 provides data on *C. coli* MICs by antimicrobial agent.

The NARMS 1997-1999 Annual Reports are posted on the NARMS Website. The address is www.cdc.gov./ncidod/dbmd/narms

National Antimicrobial Resistance Monitoring System: Enteric Bacteria 1999 Publications and Presentations

Publications

1. Zirnstein G, Li Y, Swaminathan B, Angulo F. Ciprofloxacin resistance in *Campylobacter jejuni* isolates: Dectection of gyrA resistance mutations by MAMA PCR and DNA sequence analysis. Journal of Clinical Microbiology 1999; 37: 3276-3280.

Abstracts

1. Dunne E, Fey P, Shillam P, Kludt P, Keene W, Harvey E, Stamey K, Barrett T, Marano N, Angulo F. Emergence of domestically acquired AmpC-mediated ceftriaxone-resistant *Salmonella* serotype Typhimurium (ST) infections. In Program and Abstracts of 39th Interscience Conference on Antimicrobial Agents and Chemotherapy, 1999 September, San Francisco, CA.

2. Fiorentino T, Howard R, Kinney A, Marcus R, Mshar P, Marano N, Westerman J, Reddy S, Angulo F. Routine subtyping of *Salmonella* serotype Typhimurium by PFGE facilitates focused epidemiological investigations in Connecticut. In Program and Abstracts of 39th Interscience Conference on Antimicrobial Agents and Chemotherapy, 1999 September, San Francisco, CA.

3. Fontana J, Bagshaw J, Angulo F, Marano N, Shea D, Goddard A, George H. Plasmid DNA associated with specific bands in PFGE patterns of antibiotic-resistant *Salmonella* serotype Enteritidis. In Program and Abstracts of 39th Interscience Conference on Antimicrobial Agents and Chemotherapy, 1999 September, San Francisco, CA.

4. Hollinger K, Bager F, Marano N, Angulo F, Aaerestrup F, Tollefson L, Gerner-Smidt, Wegener H. Aminoglycoside (AG) resistance in the United States and Denmark: an association between resistance and AG use in food animals, particularly in US poultry sources. In Program and Abstracts of 39th Interscience Conference on Antimicrobial Agents and Chemotherapy, 1999 September, San Francisco, CA.

5. Hollinger K, Silvers L, Marano N, Fedorka-Cray P, Angulo F, Tollefson L, Stamey K. Antibiotic resistance in *Salmonella enterica* Serotypes Heidelberg, Kentucky, and Thompson isolated from human and broiler chicken sources. In Program and Abstracts of 39th Interscience Conference on Antimicrobial Agents and Chemotherapy, 1999 September, San Francisco, CA.

6. Marano N, Benson J, Koehler J, MacKinson C, Wang Y, Madden J, Debess E, Hill B, Archibald L, Boel J, Wegener H, Angulo F. Presence of high-level gentamicin-resistant (HLGR) enterococci in humans and retail chicken products in the US, but not Denmark. In Program and Abstracts of 39th Interscience Conference on Antimicrobial Agents and Chemotherapy, 1999 September, San Francisco, CA.

7. Marano N, Stamey K, Barrett T, Angulo F. High prevalence of gentamicin resistance among selected *Salmonella* serotypes in the US: associated with heavy use of gentamicin in poultry? In Program and Abstracts of Infectious Disease Society of America 37th Annual Meeting, 1999 November, Philadelphia, PA.

8. Marano N, Stamey K, Barrett TJ, Angulo FJ and NARMS: Enteric Bacteria Working Group. The national antimicrobial resistance monitoring system (NARMS): trends in antimicrobial resistance. Emerging Antibiotic Resistance in Foodborne Enteric Pathogens Conference,1999 August, Athens, GA.

9. Marano N, Stamey K, Barrett TJ, Bopp C, Dabney P, Angulo FJ and the NARMS Working Group. Emerging quinolone-and-extended spectrum cephalosporin-resistant *Salmonella* in the United States.. In Program and Abstracts of American Society for Microbiology, 99th General Meeting, 1999 May, Chicago, IL.

10. Marano N, Stamey K, Barrett TJ, Angulo FJ and NARMS: Enteric Bacteria Working Group. Antibiotic resistance among human *Campylobacter* isolates in the United States, 1997-1998. *Campylobacter*, *Helicobacter* and Related Organisms Conference, 1999 September, Baltimore, MD.

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 1. Population size and number of isolates received and tested, by site, 1999

Site	Pop. Size*		Non-Typhi *Salmonella*		*Salmonella* Typhi		*Shigella*		*E. coli*		*Campylobacter* **	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
California [1]	2,162,359	(2)	54	(4)	6	(4)	5	(1)	6	(2)	48	(15)
Colorado	4,056,133	(4)	79	(5)	2	(1)	18	(5)	15	(5)		
Connecticut	3,282,031	(3)	63	(4)	6	(4)	7	(2)	20	(7)	53	(16)
Florida	15,111,244	(15)	100	(7)	19	(11)	14	(4)	13	(4)		
Georgia	7,788,240	(8)	126	(8)	2	(1)	19	(5)	14	(5)	52	(16)
Kansas	2,654,052	(3)	27	(2)	1	(1)	5	(1)	4	(1)		
Los Angeles [2]	9,329,989	(9)	134	(9)	25	(15)	19	(5)	3	(1)		
Maryland	5,171,634	(5)	48	(3)	3	(2)	2	(1)	5	(2)	22	(7)
Massachusetts	6,175,169	(6)	123	(8)	17	(10)	80	(21)	40	(14)		
Minnesota	4,775,508	(5)	62	(4)	4	(2)	19	(5)	32	(11)	42	(13)
New Jersey	8,143,412	(8)	133	(9)	22	(13)	34	(9)	22	(8)		
New York City [3]	7,428,524	(7)	174	(12)	37	(22)	50	(13)	1	(0)		
New York State [4]	10,768,077	(10)	146	(10)	10	(6)	12	(3)	58	(20)	54	(17)
Oregon	3,316,154	(3)	44	(3)	4	(2)	9	(2)	12	(4)	34	(11)
Tennessee	5,483,535	(5)	70	(5)	1	(1)	65	(17)	12	(4)	14	(4)
Washington	5,756,361	(6)	96	(6)	7	(4)	13	(4)	31	(11)		
West Virginia	1,806,928	(2)	20	(1)	0	(0)	4	(1)	4	(1)		
Totals	103,209,350	(100)	1499	(100)	166	(100)	375	(100)	292	(100)	319	(100)

* County population 1999, U.S. Census Bureau, post-census estimates
** *Campylobacter* isolates are submitted only from FoodNet sites, population size of FoodNet sites is 25.6 million persons (see http://www.cdc.gov/ncidod/dbmd/foodnet/default.htm)
(1) San Francisco and Alameda Counties
(2) Los Angeles County
(3) Five boroughs of New York City (Bronx, Brooklyn, Manhattan, Queens, Staten Island)
(4) Excluding New York City

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 2. Antimicrobial agents used for susceptibility testing for *Salmonella*, *Shigella*, *E. coli* O157, and *Campylobacter* isolates

Antimicrobial Agent	Antimicrobial Agent Concentration Range (µg/ml)	Breakpoints [R]	[I]	[S]	Code
Amikacin	4 - 32	≥ 64	32	≤ 16	Ak
Amoxicillin – Clavulanic Acid	0.5/0.25 – 32/16	≥ 32	16	≤ 8	Cv
Ampicillin	2 – 64	≥ 32	16	≤ 8	A
Apramycin**	2 – 16	≥ 32	16	≤ 8	Ap
Azithromycin*	0.016 – 256	≥ 2	0.5-1	≤ 0.25	Az
Ceftiofur**	0.5 – 16	≥ 8	4	≤ 2	Cf
Ceftriaxone	0.25 – 64	≥ 64	32	≤ 8	Cx
Cephalothin	1 – 32	≥ 32	16	≤ 8	Ce
Chloramphenicol Chloramphenicol*	4 – 32 0.125 – 256	≥ 32 ≥ 32	16 16	≤ 8 ≤ 8	C
Ciprofloxacin Ciprofloxacin*	0.015 – 2 0.016 – 32	≥ 4 ≥ 4	2 2	≤ 1 ≤ 1	Cp
Clindamycin*	0.032 – 256	≥ 4	1-2	≤ 0.5	Cl
Erythromycin*	0.047 – 256	≥ 8	1-4	≤ 0.5	E
Florfenicol**	2-16	≥ 16			F
Gentamicin Gentamicin*	0.25 – 16 0.025 – 16	≥ 16 ≥ 16	8 8	≤ 4 ≤ 4	G
Kanamycin	16 – 64	≥ 64	32	≤ 16	K
Nalidixic Acid Nalidixic Acid*	4 – 64 0.047 - 256	≥ 32 ≥ 32		≤ 16 ≤ 16	Na
Streptomycin	32 – 356	≥ 64		≤ 32	S
Sulfamethoxazole	128 – 512	≥ 512		≤ 256	Su
Tetracycline Tetracycline*	4 – 64 0.023 – 32	≥ 16 ≥ 16	8 8	≤ 4 ≤ 4	T
Trimethoprim - Sulfamethoxazole	0.12/2.4 – 4/76	≥ 4/76		≤ 2/38	Tm

* Campylobacter antimicrobial agents and concentration ranges used

** No NCCLS interpretive standards for this antimicrobial agent (veterinary use only)

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 3. Antimicrobial resistance of *Salmonella, Shigella,* and *E. coli* O157 isolates, 1999

Antimicrobial Agent	Non-Typhi *Salmonella* (N=1499)		*Salmonella* Typhi (N=166)		*Shigella* (N=375)		*E. coli* O157 (N=292)	
	N	%	N	%	N	%	N	%
Amikacin	0	0	0	0	0	0	0	0
Amoxicillin – Clavulanic Acid	36	2	1	0.6	4	1	1	0.3
Ampicillin	234	16	21	13	291	77	4	1
Apramycin	5	0.3	0	0	0	0	0	0
Ceftiofur	31	2	2	1	0	0	0	0
Ceftriaxone	6	0.4	1	0.6	0	0	0	0
Cephalothin	55	4	4	2	12	3	2	1
Chloramphenicol	138	9	20	12	65	17	0	0
Ciprofloxacin	1	0.1	0	0	0	0	0	0
Florfenicol	128	8	0	0	0	0	0	0
Gentamicin	34	2	0	0	1	0.3	1	0.3
Kanamycin	66	4	0	0	2	0.5	2	1
Nalidixic Acid	16	1	31	19	6	2	2	1
Streptomycin	254	17	23	14	209	56	8	3
Sulfamethoxazole	272	18	28	17	210	55	24	8
Tetracycline	292	19	15	9	215	57	10	3
Trimethoprim - Sulfamethoxazole	31	2	21	13	193	51	4	1

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 4a. Non-Typhi *Salmonella* submissions by site and by month of collection, 1999

Site	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CA	54	2	4	3	4	3	5	7	5	7	4	5	5
CO	79	4	6	8	7	9	9	7	9	7	3	5	5
CT	64	3	3	4	3	5	7	9	7	7	7	3	6
FL	100	2	7	6	4	5	10	8	7	15	13	15	8
GA	130	9	7	10	7	8	12	17	11	16	14	10	9
KS	27	1	1	2	2	2	3	3	4	4	2	2	1
LX	134	8	5	8	8	8	11	21	18	13	14	11	9
MA	130	7	5	9	6	11	15	16	15	16	8	12	10
MD	48	3	0	2	1	3	1	11	7	7	5	4	4
MN	62	3	4	4	6	4	5	11	8	6	4	4	3
NJ	134	9	9	7	8	9	11	14	17	18	10	10	12
NYC	176	13	11	10	10	8	16	23	20	21	15	14	15
NYS	146	8	5	7	7	14	13	32	16	11	11	11	11
OR	44	3	4	2	2	3	8	6	4	3	2	3	4
TN	70	6	2	4	2	7	7	11	11	4	7	5	4
WA	96	5	7	7	4	5	16	14	10	6	6	6	10
WV	20	1	2	1	1	1	4	0	3	3	2	1	1
Total	**1514**	87	82	94	82	105	153	210	172	164	127	121	117

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 4b. *Salmonella* Typhi submissions by site and by month of collection, 1999

Site	**Total**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
CA	11	0	3	2	2	1	0	1	0	0	1	0	1
CO	2	0	0	0	0	0	2	0	0	0	0	0	0
CT	8	0	0	1	1	0	2	2	1	0	0	0	1
FL	20	7	8	0	3	1	0	0	0	1	0	0	0
GA	3	0	0	0	0	0	1	0	0	1	0	0	1
KS	1	0	0	0	0	0	0	0	1	0	0	0	0
LX	59	13	14	6	1	3	1	2	1	5	5	1	7
MA	18	0	3	3	1	0	0	7	0	0	0	3	1
MD	3	0	0	0	0	1	0	1	1	0	0	0	0
MN	4	0	0	0	2	0	0	1	1	0	0	0	0
NJ	36	0	4	4	1	7	1	2	3	9	3	1	1
NYC	52	2	6	2	3	1	4	4	12	1	5	6	6
NYS	14	2	4	0	0	3	0	0	1	3	1	0	0
OR	7	0	0	1	1	2	1	2	0	0	0	0	0
TN	1	0	0	1	0	0	0	0	0	0	0	0	0
WA	10	1	0	4	0	1	0	1	0	0	0	3	0
WV	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**249**	25	42	24	15	20	12	23	21	20	15	14	18

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 4c. *Shigella* submissions by site and by month of collection, 1999

Site	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CA	5	0	0	0	0	0	0	0	3	0	1	1	0
CO	18	1	1	0	2	0	0	2	2	4	1	3	2
CT	7	0	0	0	1	1	1	0	1	1	0	1	1
FL	14	1	0	3	2	4	1	1	1	0	0	1	0
GA	19	1	1	1	2	1	1	3	2	1	3	2	1
KS	5	0	0	0	0	1	0	1	1	0	0	2	0
LX	19	3	1	2	1	1	1	1	2	2	2	1	2
MA	80	1	3	2	1	1	3	6	20	15	14	10	4
MD	2	0	1	0	0	0	0	1	0	0	0	0	0
MN	19	1	0	1	1	2	4	2	2	1	2	2	1
NJ	34	2	3	4	3	2	2	3	3	4	3	3	2
NYC	51	4	4	6	3	0	5	6	6	5	4	4	4
NYS	12	3	1	1	1	0	0	1	2	2	1	0	0
OR	9	1	0	1	0	0	1	0	2	1	1	1	1
TN	65	10	4	4	2	8	15	2	3	2	3	3	9
WA	14	1	1	1	1	1	1	1	1	2	1	1	2
WV	4	0	1	0	0	0	1	0	0	1	1	0	0
Total	**377**	29	21	26	20	22	36	30	51	41	37	35	29

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 4d. *E. coli* O157 submissions by site and by month of collection, 1999

Site	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CA	6	1	0	0	0	0	1	1	0	1	1	1	0
CO	15	1	0	1	0	1	1	4	1	5	0	0	1
CT	20	2	0	1	1	1	0	6	4	2	2	1	0
FL	13	1	0	0	1	0	3	2	3	1	1	1	0
GA	14	1	0	0	2	0	1	2	1	1	1	2	3
KS	4	0	0	0	0	0	0	1	1	1	0	0	1
LX	3	0	0	0	1	0	0	1	0	0	1	0	0
MA	40	1	2	1	1	4	2	10	4	8	4	2	1
MD	5	0	0	0	0	1	0	1	0	2	1	0	0
MN	32	1	1	0	1	1	5	7	6	3	5	1	1
NJ	22	0	1	0	1	2	3	3	3	3	2	2	2
NYC	1	0	0	0	0	0	0	1	0	0	0	0	0
NYS	61	1	0	0	3	2	9	8	4	26	4	2	2
OR	12	1	1	0	0	1	1	2	2	3	1	0	0
TN	12	1	0	0	0	1	2	1	1	2	2	2	0
WA	31	0	0	1	2	0	2	4	8	6	5	2	1
WV	5	1	0	0	0	0	1	0	0	2	0	1	0
Total	**296**	12	5	4	13	14	31	54	38	66	30	17	12

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 4e. *Campylobacter* submissions by site and by month of collection, 1999

Site	**Total**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
CA	48	4	4	4	4	4	4	4	4	4	4	4	4
CT	53	4	6	4	5	5	3	4	4	4	5	3	6
GA	52	4	5	3	4	4	5	4	0	9	5	4	5
MD	22	4	0	2	1	2	5	0	0	0	0	6	2
MN	42	4	4	5	4	0	4	4	5	3	0	5	4
NYS	54	5	3	4	2	5	6	7	6	5	5	2	4
OR	34	3	1	0	3	7	6	4	3	0	1	3	3
TN	14	2	1	0	0	2	4	0	0	0	2	0	3
Total	**319**	30	24	22	23	29	37	27	22	25	22	27	31

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 5. Frequency of non-Typhi *Salmonella* Serotypes, 1999

Serotype	N	%
Typhimurium	362	24.2
Enteritidis	269	17.9
Newport	97	6.5
Heidelberg	89	5.9
Montevideo	52	3.5
Muenchen	51	3.4
Javiana	42	2.8
St. Paul	35	2.3
Agona	33	2.2
Thompson	32	2.1
Braenderup	24	1.6
Oranienburg	24	1.6
Hadar	21	1.4
Infantis	17	1.1
Stanley	17	1.1
Not Serotyped	17	1.1
All Others	317	21.1
Total	1499	100

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 6. Frequency of non-Typhi *Salmonella* Serotypes / Frequency of Pansusceptibility* Among Serotypes, 1996-1999

Selected Salmonella Serotypes: NARMS 1996-1999
1999

Serotype	Total Isolates		Pansusceptible Isolates	
	#	% of Salmonella	#	% of Serotype
Javiana	42	3.6	41	97.6
Thompson	32	2.8	31	96.9
Braenderup	24	2.1	23	95.8
Oranienburg	24	2.1	23	95.8
Infantis	17	1.5	16	94.1
Muenchen	51	4.4	47	92.2
Montevideo	52	4.5	47	90.4
Enteritidis	269	23.1	225	83.6
St. Paul	35	3.0	29	82.9
Newport	97	8.3	74	76.3
Stanley	17	1.5	12	70.6
Heidelberg	89	7.6	61	68.5
Agona	33	2.8	21	63.6
Typhimurium	362	31.1	183	50.6
Hadar	21	1.8	0	0

1998

Serotype	Total Isolates		Pansusceptible Isolates	
	#	% of Salmonella	#	% of Serotype
Braenderup	23	1.6	23	100
Miami	10	0.7	10	100
Mississippi	16	1.1	16	100
Poona	12	0.8	12	100
Thompson	24	1.7	24	100
Oranienburg	33	2.3	32	96.7
Javiana	54	3.7	52	96.3
Newport	79	5.5	73	92.4
Montevideo	33	2.3	30	91.0
Infantis	22	1.5	20	90.9
Muenchen	30	2.1	27	90
Enteritidis	245	16.9	214	87.3
Brandenburg	10	0.7	8	80
St. Paul	31	2.1	24	77.4
Stanley	10	0.7	6	60
Agona	39	2.7	23	59.0
Heidelberg	103	7.1	58	56.3
Schwarzengrund	14	1.0	7	50
Typhimurium	378	26.0	176	46.6
Hadar	26	1.8	0	0

***Pansusceptible to antimicrobial agents tested all 4 years: amoxicillin-clavulanic acid, ampicillin, apramycin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole**

National Antimicrobial Resistance Monitoring System For Enteric Bacteria
1999 Annual Report

Table 6. Frequency of non-Typhi *Salmonella* Serotypes / Frequency of Pansusceptibility* Among Serotypes, 1996-1999 (continued)

1997

Serotype	Total Isolates		Pansusceptible isolates	
	#	% of Salmonella	#	% of Serotype
Javiana	19	1.5	19	100
Thompson	32	2.5	31	96.9
Infantis	29	2.3	28	96.6
Montevideo	27	2.1	26	96.3
Braenderup	17	1.3	16	94.1
Oranienburg	27	2.1	25	92.6
Newport	48	2.7	42	87.5
Poona	13	1.0	11	84.6
St. Paul	19	1.5	16	84.2
Adelaide	10	0.8	8	80.0
Enteritidis	301	23.5	223	74.1
Muenchen	17	1.3	11	64.7
Heidelberg	75	5.9	48	64.0
Agona	25	2.0	13	52.0
Typhimurium	326	25.4	122	37.4
Hadar	30	2.3	1	3.3

1996

Serotype	Total Isolates		Pansusceptible isolates	
	#	% of Salmonella	#	% of Serotype
Braenderup	22	1.7	22	100
Montevideo	37	2.8	33	89.2
Javiana	27	2.0	24	88.9
Oranienburg	18	1.4	16	88.9
Java	12	0.9	10	83.3
Muenchen	17	1.3	14	82.4
Newport	51	3.8	42	82.4
Anatum	11	0.8	9	81.8
Thompson	24	1.8	19	79.2
Paratyphi-B	11	0.8	8	72.7
Infantis	18	1.4	13	72.2
Enteritidis	357	26.9	247	69.2
St. Paul	17	1.3	11	64.7
Heidelberg	74	5.6	38	51.4
Agona	12	0.9	5	41.7
Typhimurium	305	23.0	110	36.1
Hadar	38	2.9	1	2.6

***Pansusceptible to antimicrobial agents tested all 4 years: amoxicillin-clavulanic acid, ampicillin, apramycin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole**

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 7. Frequency of non-Typhi *Salmonella* Serotypes / Frequency of Multiresistance Among Serotypes, 1999

Serotype	Total		Number resistant to > 1 antimicrobial		Number resistant to > 2 antimicrobials	
	N	%	N	%	N	%
Typhimurium	362	24.4	179	49.5	166	45.9
Enteritidis	269	18.2	44	16.4	26	9.7
Newport	97	6.5	23	23.7	17	17.5
Heidelberg	89	6.0	28	31.5	25	28.1
Montevideo	52	3.5	5	9.6	5	9.6
Muenchen	51	3.4	4	7.8	4	7.8
Javiana	42	2.8	1	2.4	0	0
St. Paul	35	2.4	6	17.1	5	14.3
Agona	33	2.2	12	36.4	9	27.3
Thompson	32	2.2	1	3.1	1	3.1
Braenderup	24	1.6	1	4.2	0	0
Oranienburg	24	1.6	1	4.2	0	0
Hadar	21	1.4	21	100	18	93.3
Infantis	17	1.1	1	5.9	0	0
Stanley	17	1.1	5	29.4	5	29.4

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 8. Percentage of *S*. Typhimurium isolates with ACSSuT, ACKSSuT, or AKSSuT resistance patterns, by site, 1999

Site	Total # Typhimurium N	%		ACSSuT Typhimurium N	%	ACKSSuT Typhimurium N	%	AKSSuT Typhimurium N	%
California	6	1.7		3	50.0	1	16.7	1	16.7
Colorado	29	8.0		4	13.8	0	0	1	3.4
Connecticut	20	5.5		5	25.0	1	5.0	4	20.0
Florida	14	3.9		6	42.9	0	0	1	7.1
Georgia	24	6.6		6	25.0	0	0	2	8.3
Kansas	14	3.9		3	21.4	1	7.1	1	7.1
Los Angeles	18	5.0		8	44.4	0	0	2	11.1
Maryland	12	3.3		2	16.7	0	0	1	8.3
Massachusetts	40	11.1		6	15.0	1	2.5	4	10.0
Minnesota	19	5.3		8	42.1	1	5.2	1	5.2
New Jersey	29	8.0		11	37.9	1	3.4	2	6.9
New York City	13	3.6		4	30.8	0	0	1	7.7
New York State	49	13.5		13	26.5	1	2.0	5	10.2
Oregon	10	2.8		3	30.0	0	0	0	0
Tennessee	17	4.7		4	23.5	1	5.9	3	17.6
Washington	35	9.7		13	37.1	4	11.4	9	25.7
West Virginia	13	3.6		3	23.1	0	0	1	7.7
Totals	**362**	**100**		**102**	**28.2**	**12**	**3.3**	**39**	**10.8**

Table 9. Additional antimicrobial resistance for *S*. Typhimurium isolates with ACSSuT or AKSSuT patterns, 1999

Antimicrobial	ACSSuT		AKSSuT	
	N	%	N	%
*Amox-Clav	7	6.9	2	5.1
Ceftiofur	3	2.9	0	0
Ceftriaxone	1	1.0	0	0
Cephalothin	9	8.8	8	20.5
Chloramphenicol	--		12	30.8
Florfenicol	98	96.0	10	25.6
Gentamicin	2	2.0	2	5.1
Kanamycin	12	11.8	--	
**Trimeth-Sulfa	7	6.9	5	12.8

*Amox-Clav=Amoxicillin-Clavulanic Acid
**Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

National Antimicrobial Resistance Monitoring System for Enteric Bacteria

Table 10. Clinical source of non-Typhi *Salmonella* isolates, 1999

	Blood		Stool		Other		Unknown		Total	
Isolate	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
S. Typhimurium -- ACSSuT	3	2.9	91	89.2	6	5.9	2	2.0	102	6.8
S. Typhimurium -- AKSSuT	2	5.1	36	92.3	1	2.6	0	0	39	2.6
All other S. Typhimurium	9	4.1	199	90.0	11	5.0	2	0.9	221	14.7
S. Enteritidis	21	7.8	231	85.9	12	4.5	5	1.9	269	17.9
S. Heidelberg	9	10.1	71	79.8	8	9.0	1	1.1	89	5.9
Other *Salmonella*	35	4.5	680	87.3	50	6.4	14	1.8	779	52.0
Total	79	5.2	1308	87.3	88	5.9	24	1.6	1499	100

Table 11. Serotypes of non-Typhi *Salmonella* with reduced susceptibility to ciprofloxacin [MIC $\geq$ 0.25 µg/ml] 1999 (N=15)

Serotype	#	(%)	Total received
Enteritidis	6	40	269
Berta	2	13	10
Typhimurium	1	7	362
Choleraesuis	1	7	1
Virchow	1	7	7
Montevideo	1	7	52
Heidelberg	1	7	89
Senftenberg*	1	7	3
Skansen	1	7	1

* *S*. Senftenberg was resistant to ciprofloxacin (MIC $\geq$ 4.00 µg/ml)

Table 12. Serotypes of non-Typhi *Salmonella* with reduced susceptibility to ceftriaxone [MIC $\geq$ 16 μg/ml] 1999 (N=28)

Serotype	#	(%)	Total received
Newport*	17	60	97
Typhimurium*	7	25	362
Agona	1	4	33
Enteritidis	1	4	269
Skansen	1	4	1
Worthington*	1	4	4

* Three *S*. Newport, 2 *S*. Typhimurium, and 1 *S*. Worthington isolates were resistant to ceftriaxone (MIC $\geq$ 64.00 μg/ml)

Table 13. Frequency of *Shigella* Species, 1999

Species	**N**	**%**
sonnei	275	73.3
flexneri	87	23.2
boydii	7	1.9
dysenteriae	2	0.5
not identified	4	1.1
Total	375	100

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 14. Antimicrobial Susceptibility of *Shigella* isolates, 1999

Antibiotic	All *Shigella* (N=375)		*Shigella sonnei* (N=275)		*Shigella flexneri* (N=87)		*Shigella boydii* (N=7)	
	# Resist	% Resist	# Resist	% Resist	# Resist	% Resist	# Resist	% Resist
Amikacin	0	0	0	0	0	0	0	0
Amoxicillin – Clavulanic Acid	4	1	1	0.4	3	3	0	0
Ampicillin	291	77	219	80	67	77	0	0
Apramycin	0	0	0	0	0	0	0	0
Ceftiofur	0	0	0	0	0	0	0	0
Ceftriaxone	0	0	0	0	0	0	0	0
Cephalothin	12	3	8	3	4	4	0	0
Chloramphenicol	65	17	5	2	56	64	0	0
Ciprofloxacin	0	0	0	0	0	0	0	0
Florfenicol	0	0	0	0	0	0	0	0
Gentamicin	1	0.3	1	0.4	0	0	0	0
Kanamycin	2	0.5	2	1	0	0	0	0
Nalidixic Acid	6	2	4	1	1	1	1	14
Streptomycin	209	56	143	52	55	63	6	86
Sulfamethoxazole	210	55	150	54	51	59	6	86
Tetracycline	215	57	127	46	80	92	4	57
Trimethoprim - Sulfamethoxazole	193	51	146	53	42	48	2	29

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 15. Frequency of *Campylobacter* Species, 1999

Species	N	%
Jejuni	295	92.5
Coli	20	6.3
Fetus	2	0.6
Upsaliensis	2	0.6
Total	319	100

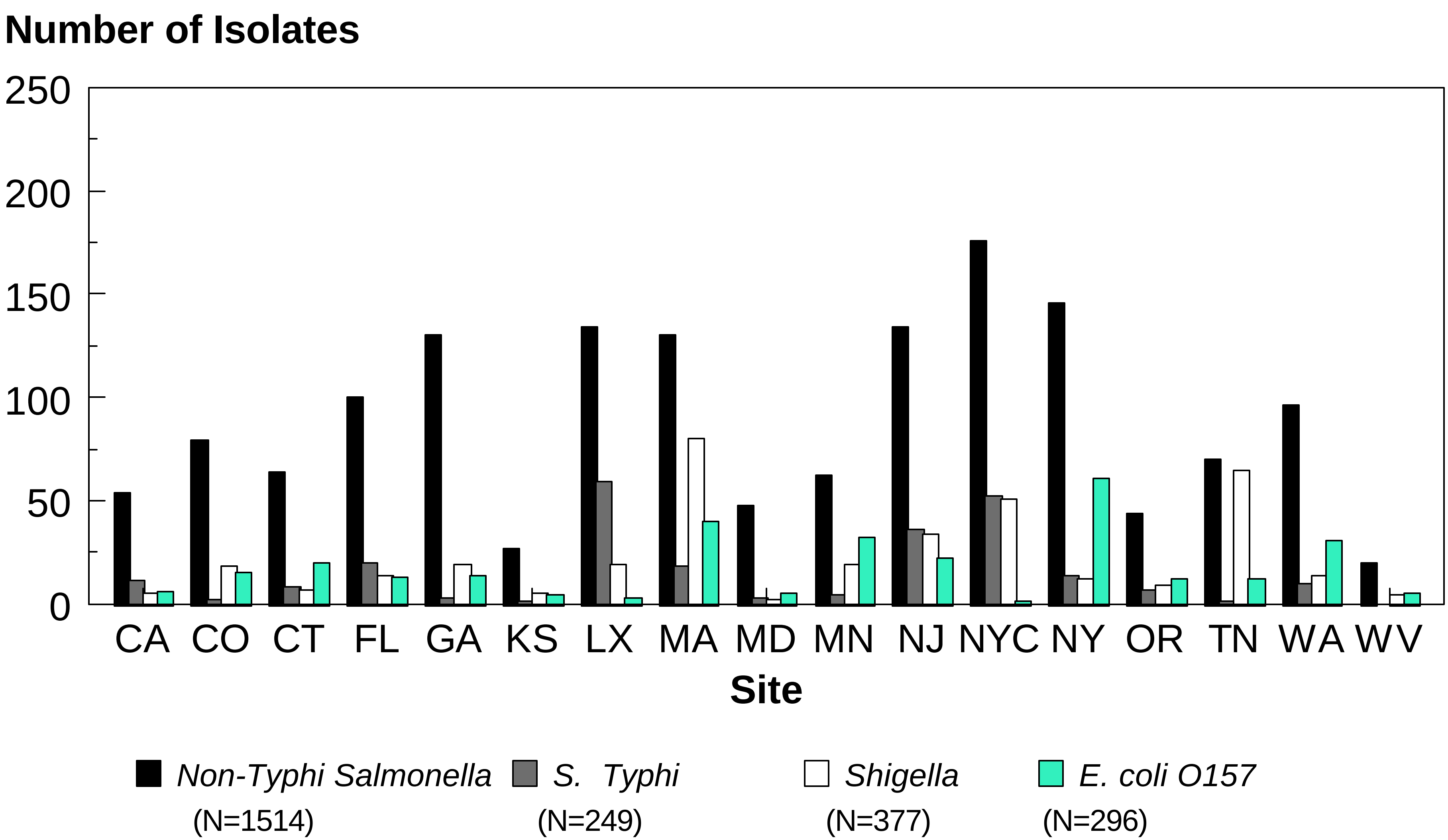
National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 16. Antimicrobial Susceptibility of *Campylobacter* isolates, 1999

Antibiotic	All *Campylobacter* (N=319)		*Campylobacter jejuni* (N=295)		*Campylobacter coli* (N=20)	
	# Resist	% Resist	# Resist	% Resist	# Resist	% Resist
Azithromycin	10	3	8	3	2	10
Chloramphenicol	1	0.3	1	0.3	0	0
Ciprofloxacin	58	18	52	18	6	30
Clindamycin	5	1	3	1	2	10
Erythromycin	8	2	6	2	2	10
Gentamicin	0	0	0	0	0	0
Nalidixic Acid	65	21	59	20	6	30
Tetracycline	141	44	135	46	6	30

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

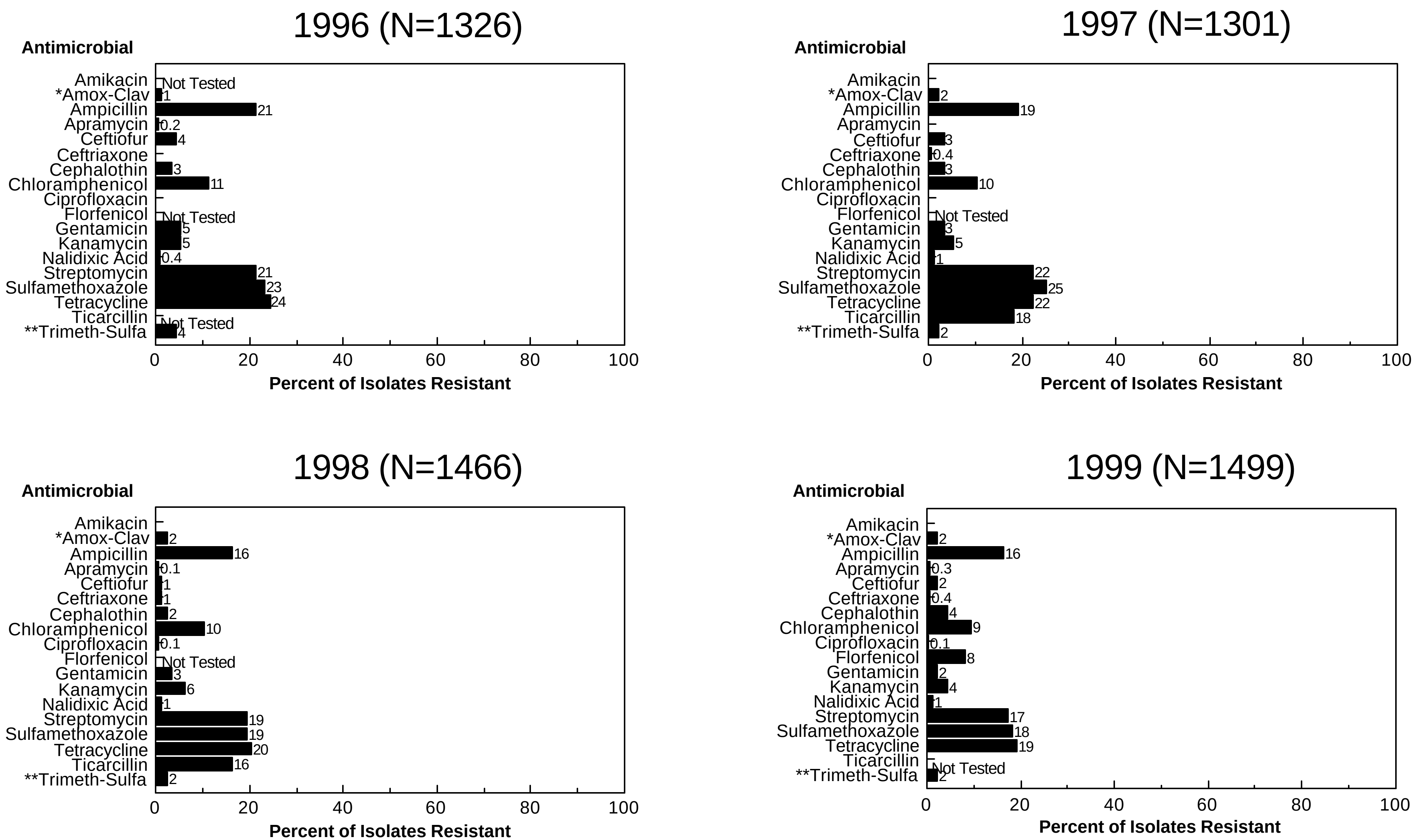
Figure 1. Number of isolates submitted, by site, 1999



LX=Los Angeles County NYC=New York City

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 2. Resistance among non-Typhi *Salmonella* isolates, 1996-1999



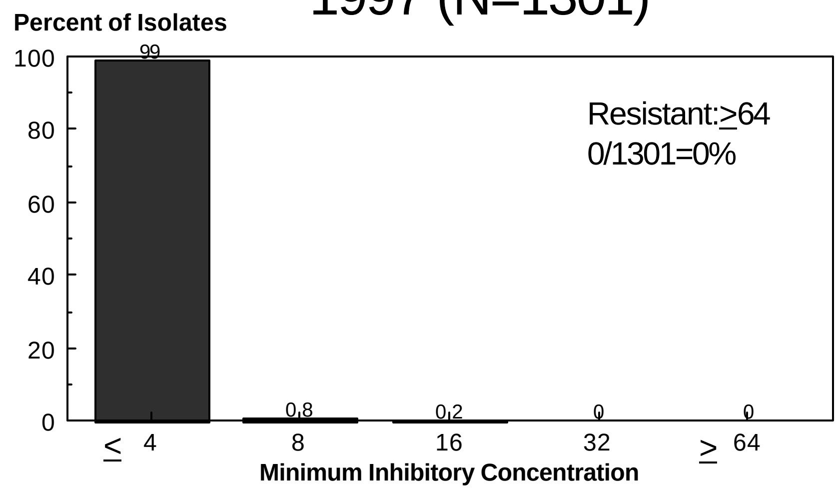
*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

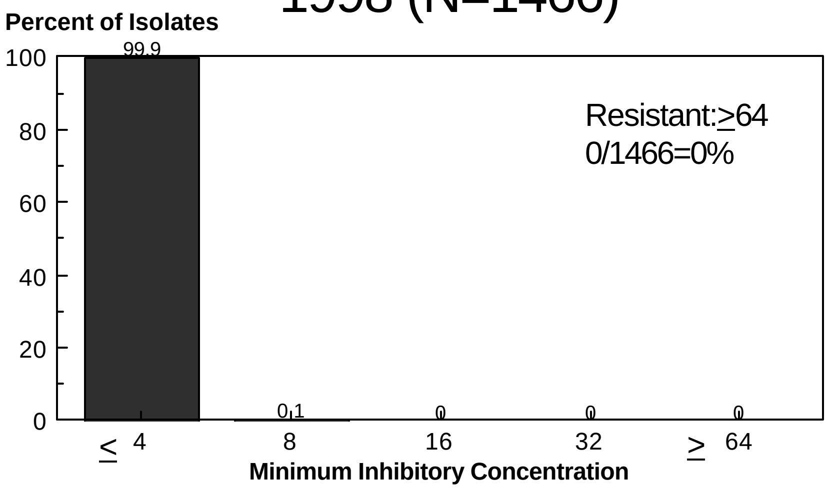
Figure 3a. MICs for Amikacin among non-Typhi *Salmonella* isolates, 1996 - 1999

Not tested in 1996

1997 (N=1301)



1998 (N=1466)



1999 (N=1499)

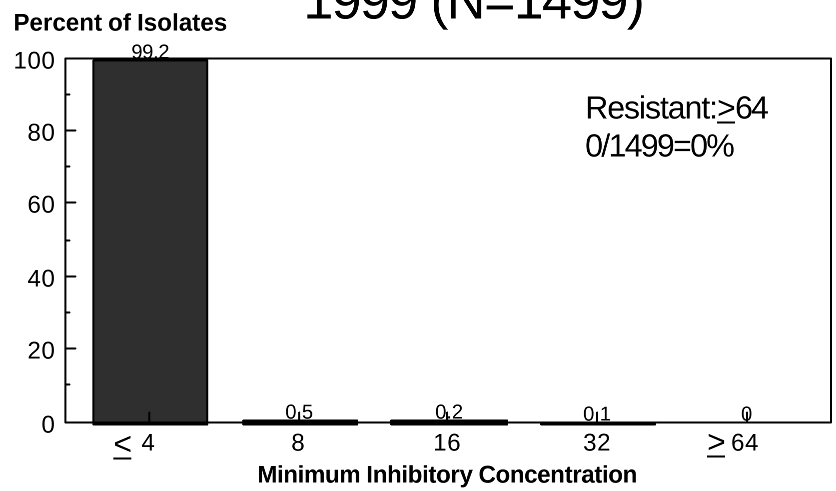


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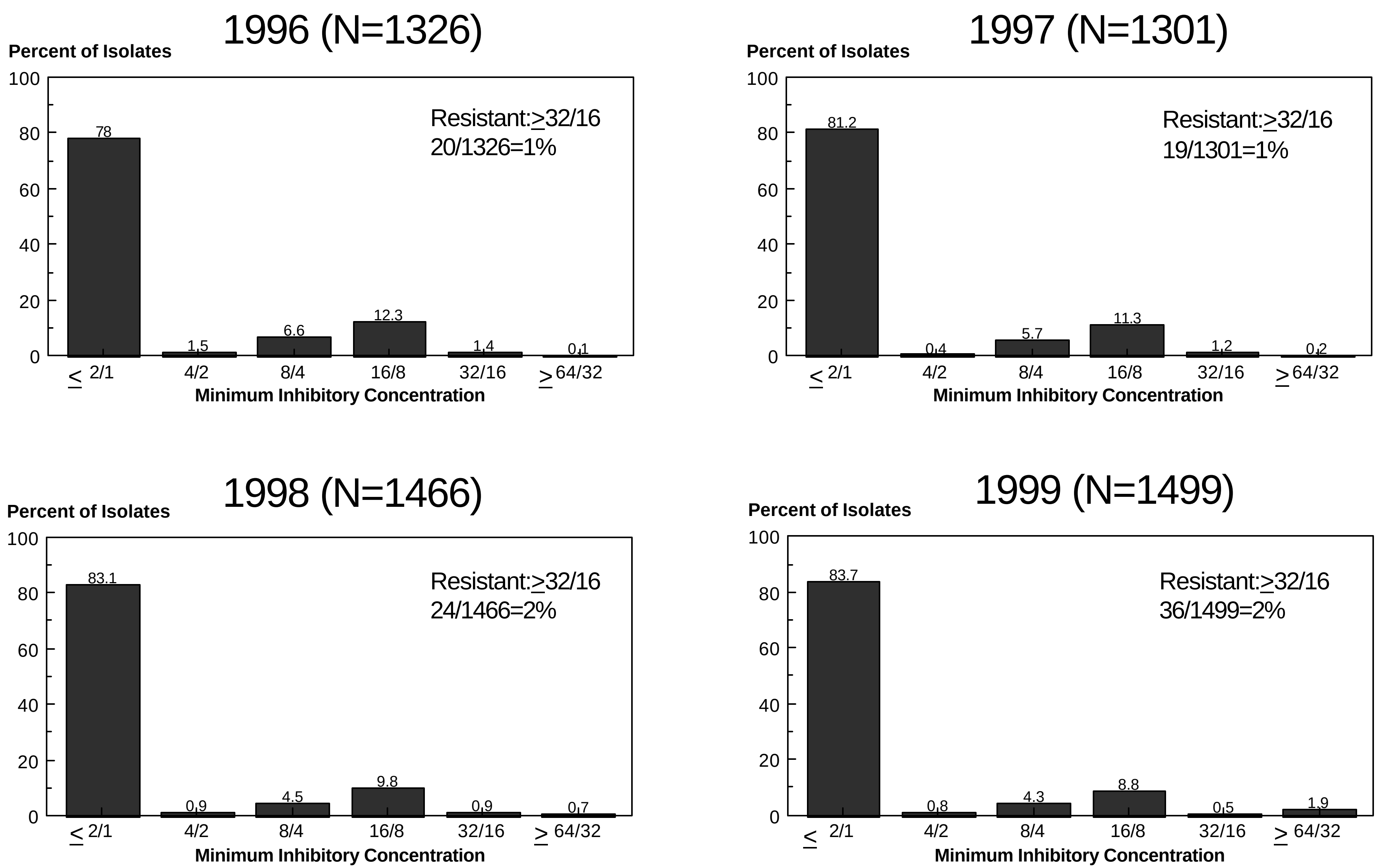
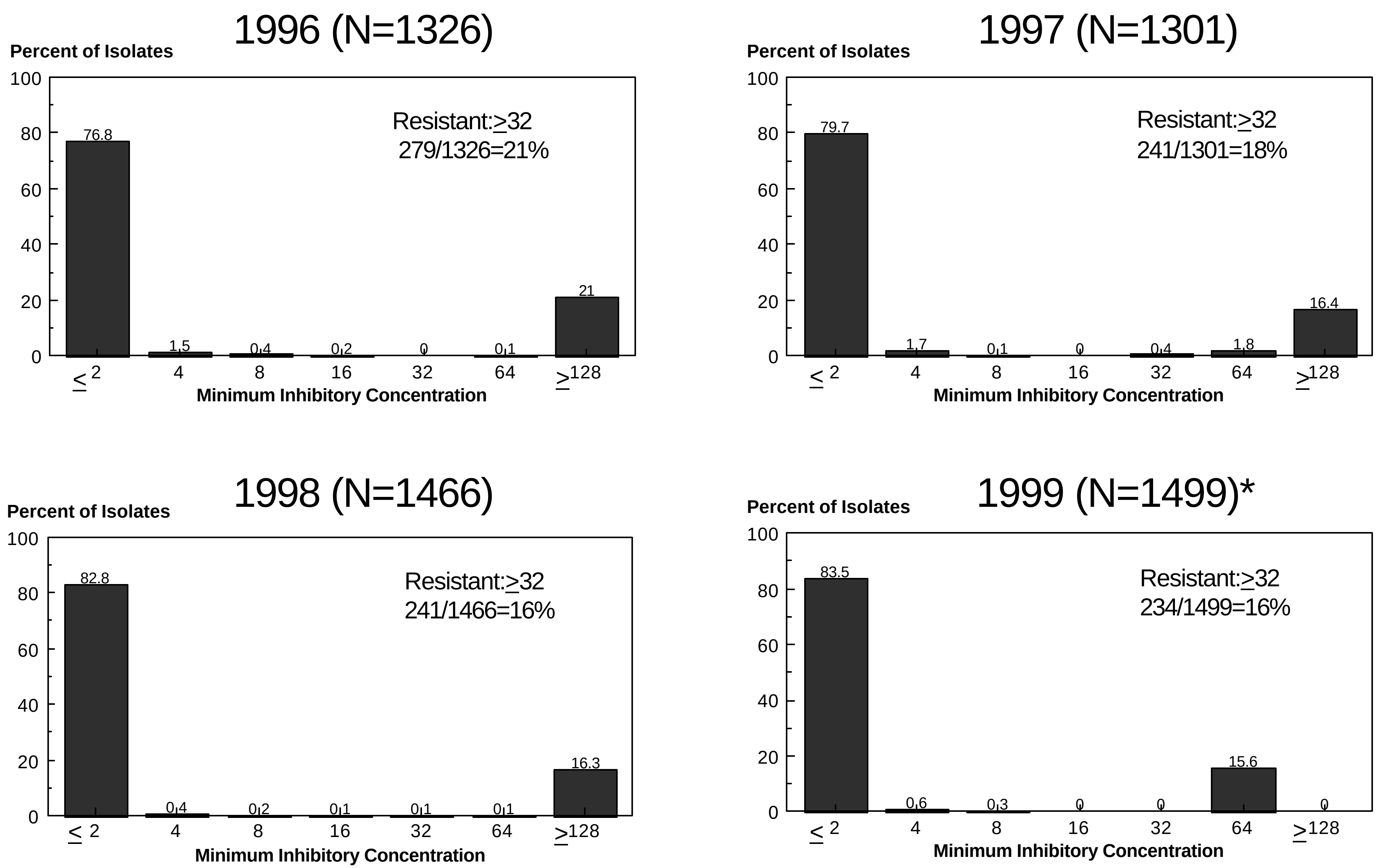
Figure 3b. MICs for Amoxicillin-Clavulanic Acid among non-Typhi *Salmonella* isolates, 1996 - 1999



National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 3c. MICs for Ampicillin among non-Typhi *Salmonella* isolates, 1996 - 1999



* Maximum MIC dilution for 1999 was 32 ug/ml. All resistant isolates had a MIC >32 ug/ml.

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 3d. MICs for Apramycin among non-Typhi *Salmonella* isolates, 1996 - 1999

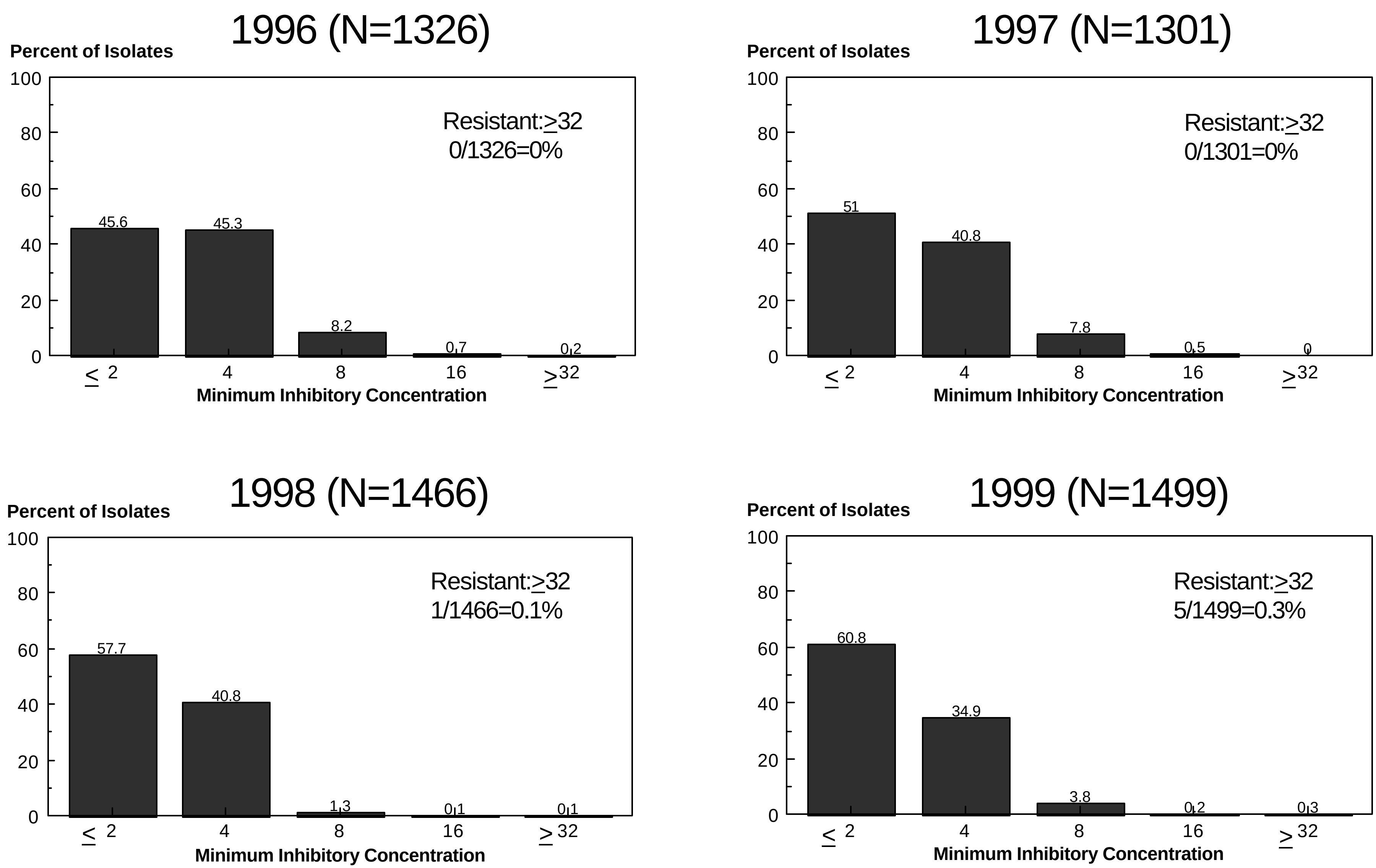


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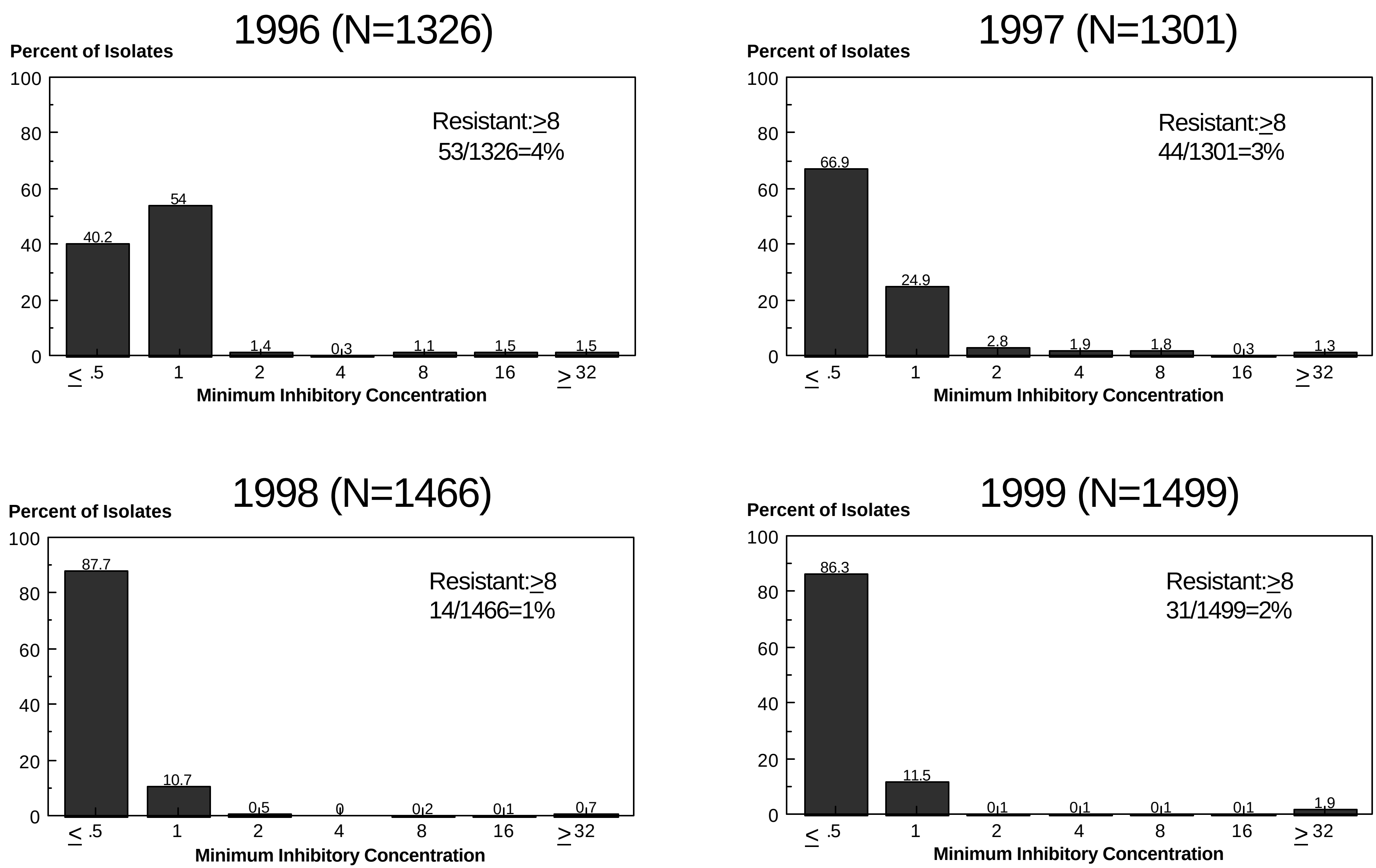
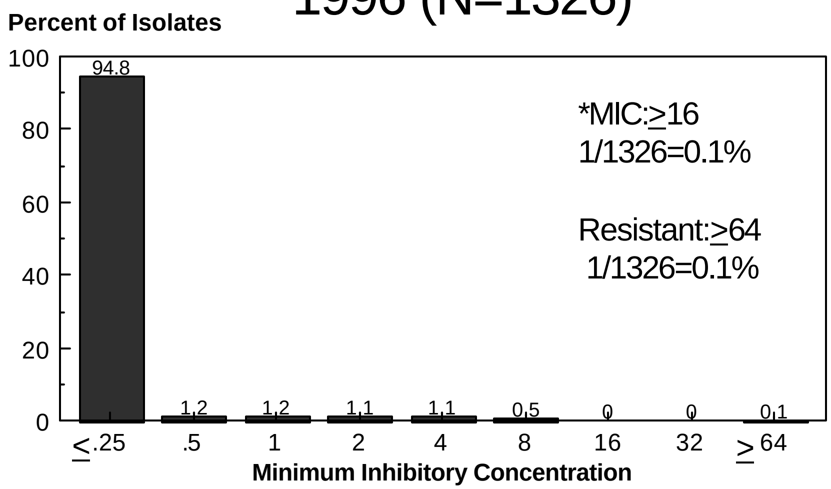
Figure 3e. MICs for Ceftiofur among non-Typhi *Salmonella* isolates, 1996 - 1999



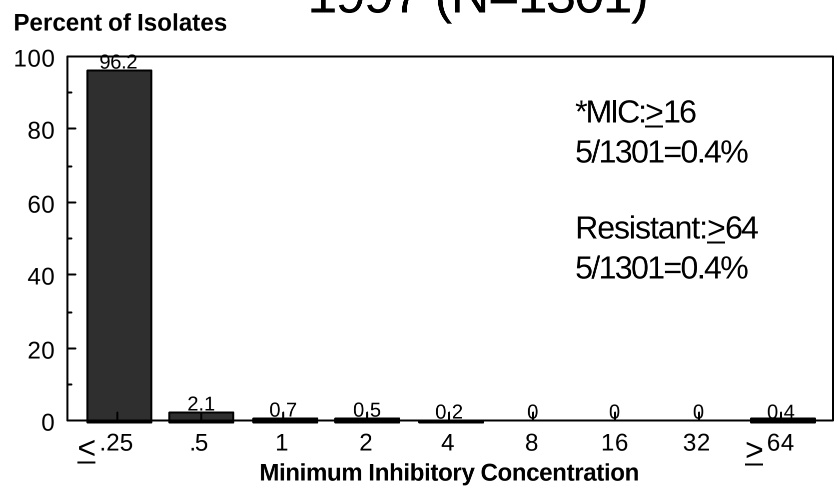
National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 3f. MICs for Ceftriaxone among non-Typhi *Salmonella* isolates, 1996 - 1999

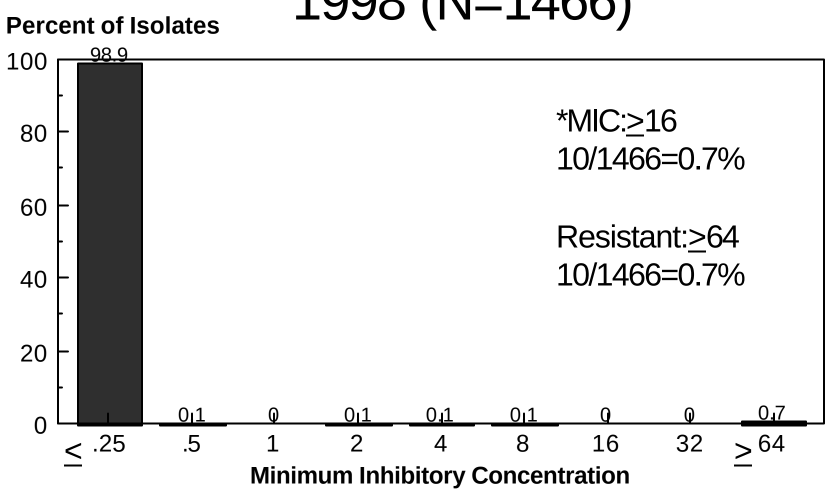
1996 (N=1326)



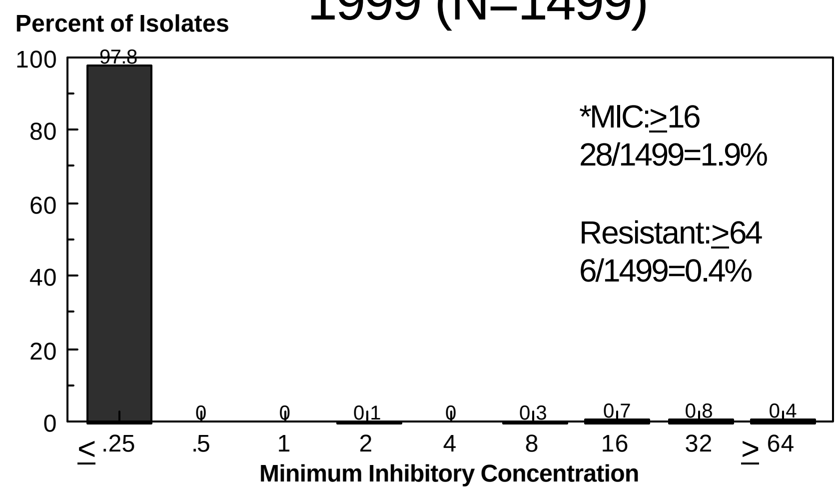
1997 (N=1301)



1998 (N=1466)



1999 (N=1499)



*MIC:>16 is decreased susceptibility.

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Figure 3g. MICs for Cephalothin among non-Typhi *Salmonella* isolates, 1996 - 1999

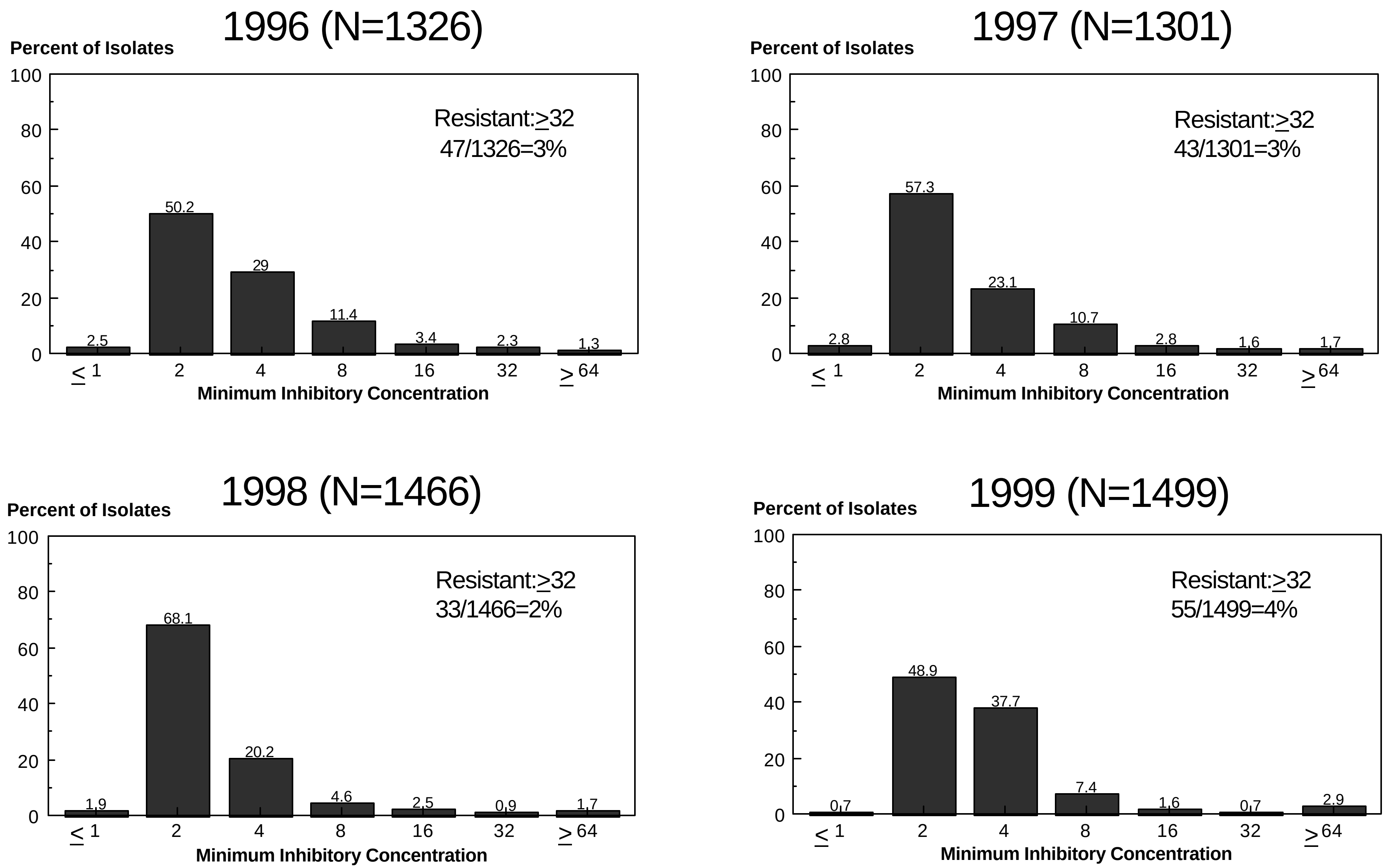

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Figure 3h. MICs for Chloramphenicol among non-Typhi *Salmonella* isolates, 1996 - 1999

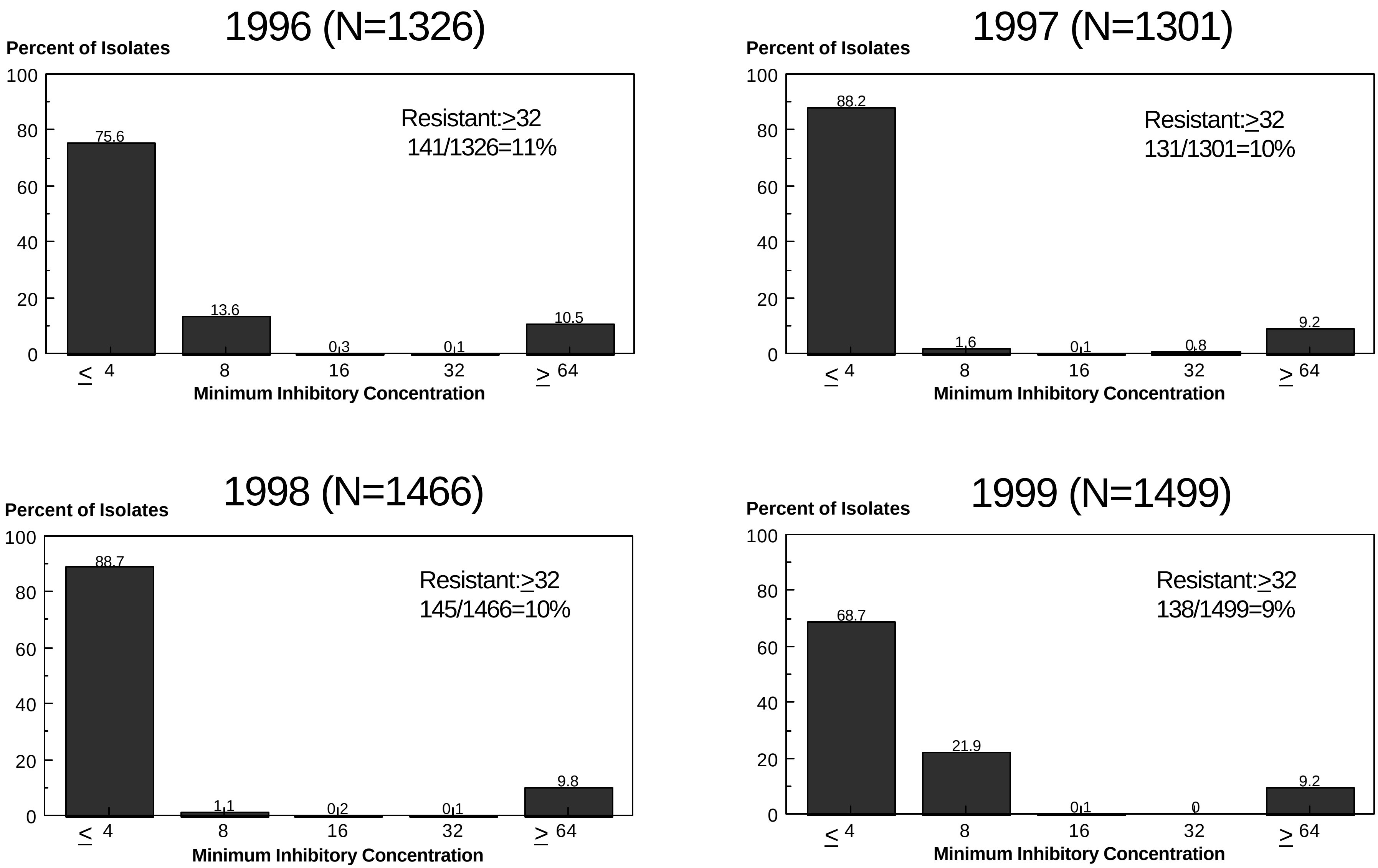

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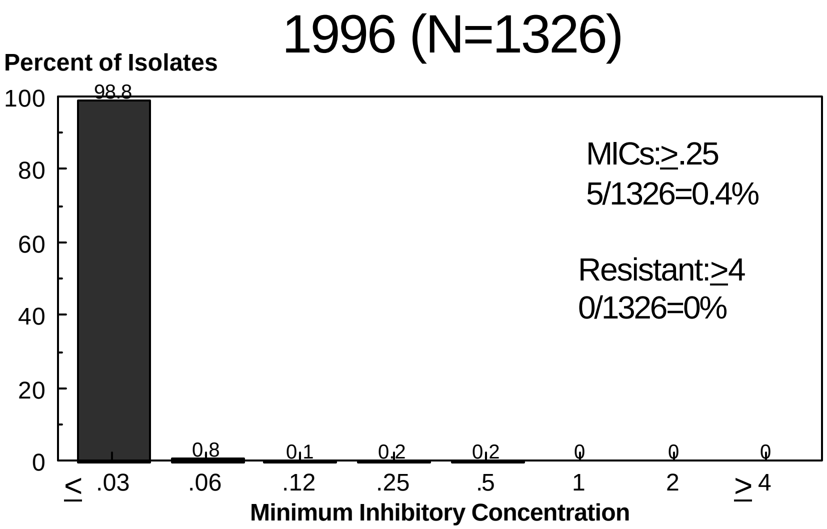
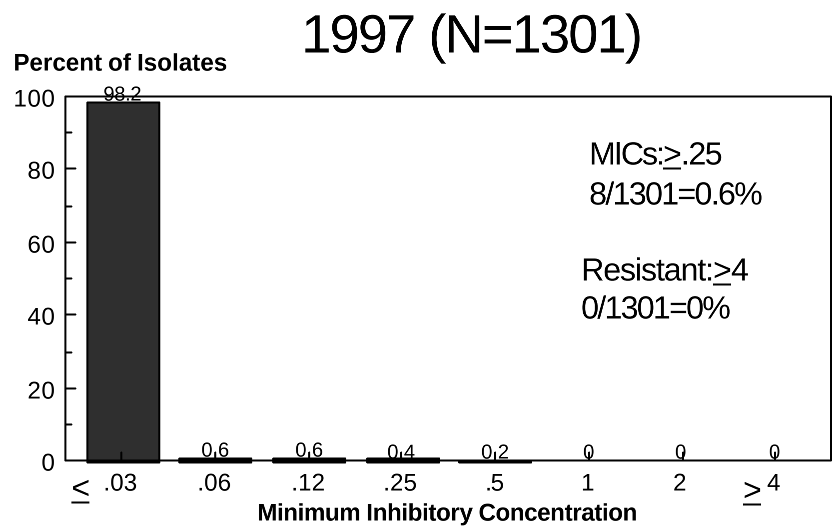
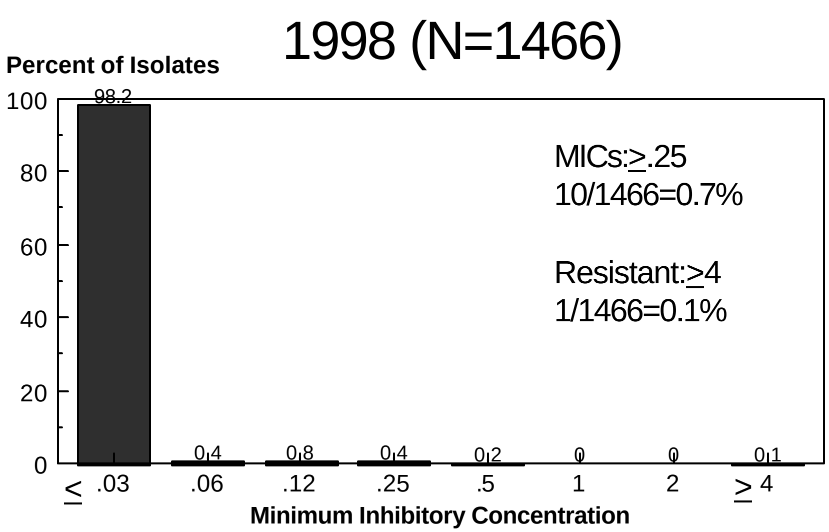
Figure 3i. MICs for Ciprofloxacin among non-Typhi *Salmonella* isolates, 1996 - 1999







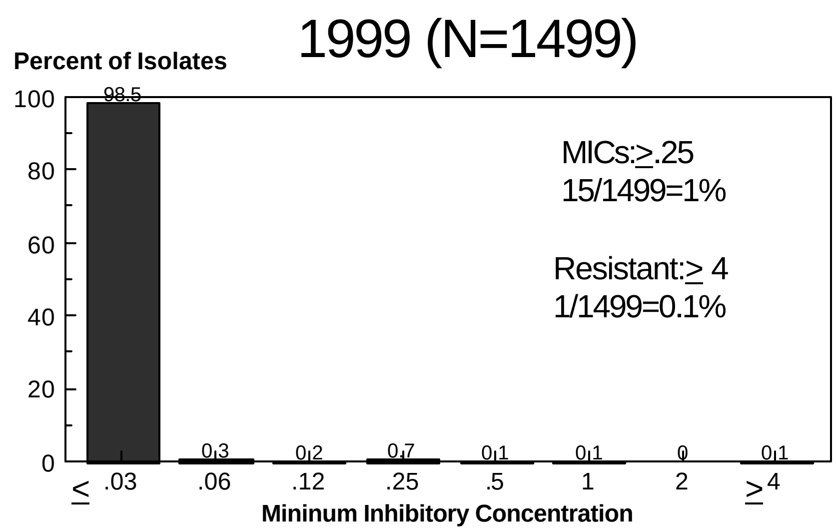


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Figure 3j. MICs for Florfenicol among non-Typhi *Salmonella* isolates, 1996 - 1999

Not tested in 1996

Not tested in 1997

Not tested in 1998

1999 (N=1499)

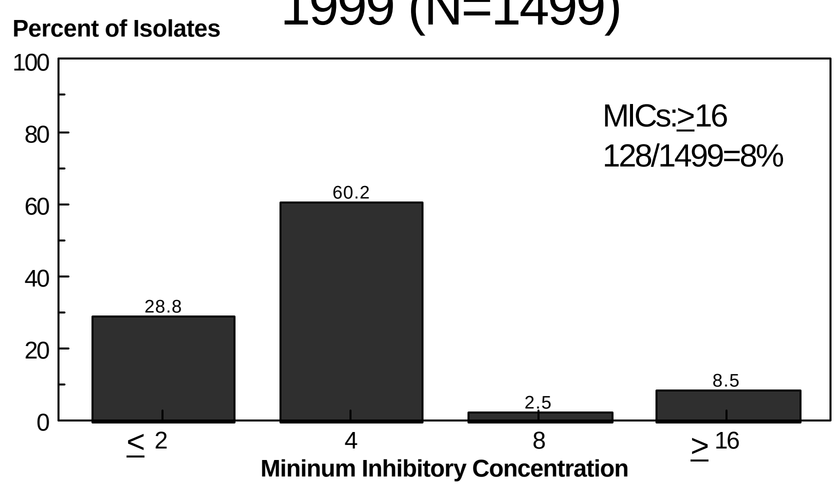

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Figure 3k. MICs for Gentamicin among non-Typhi *Salmonella* isolates, 1996 - 1999

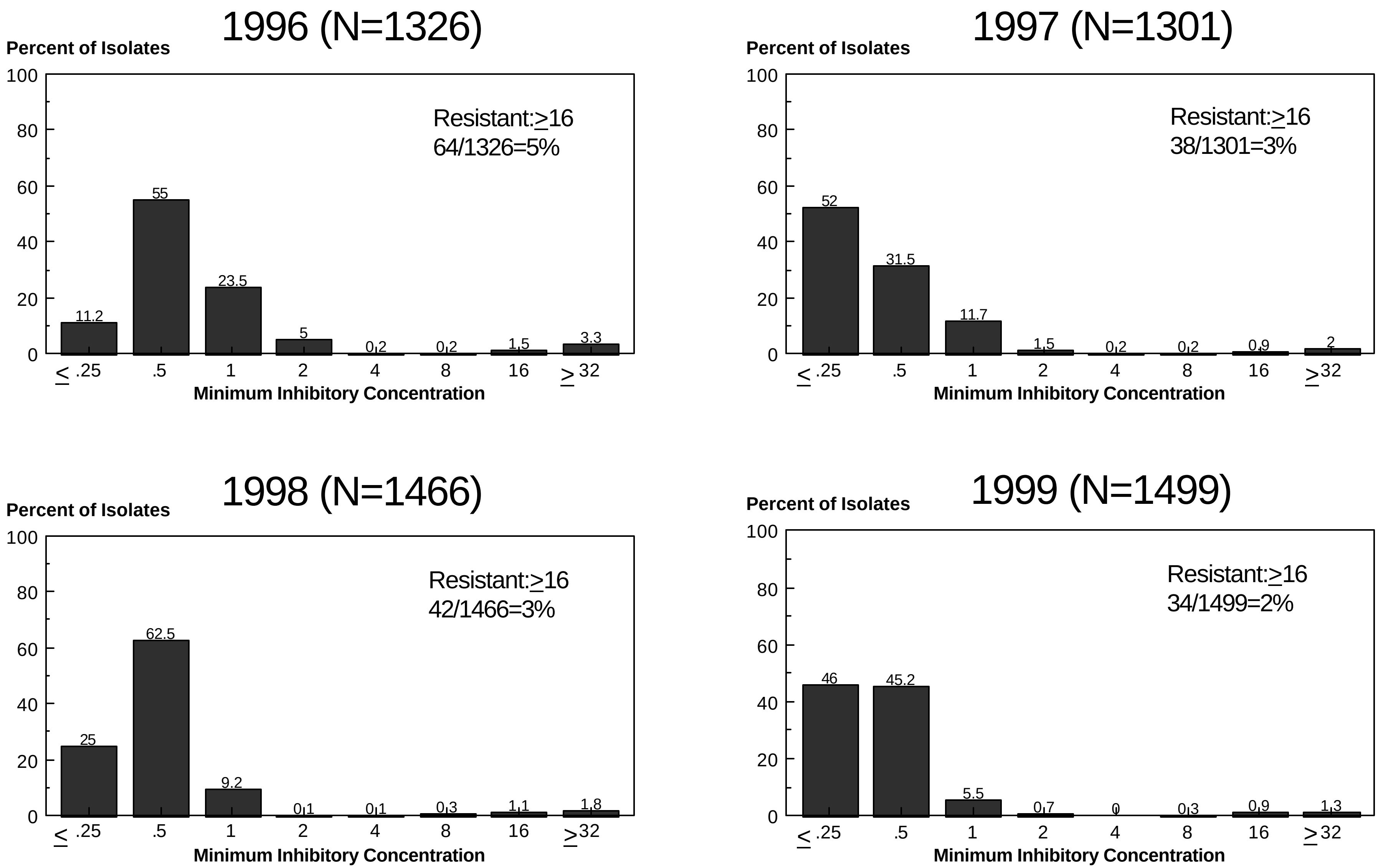

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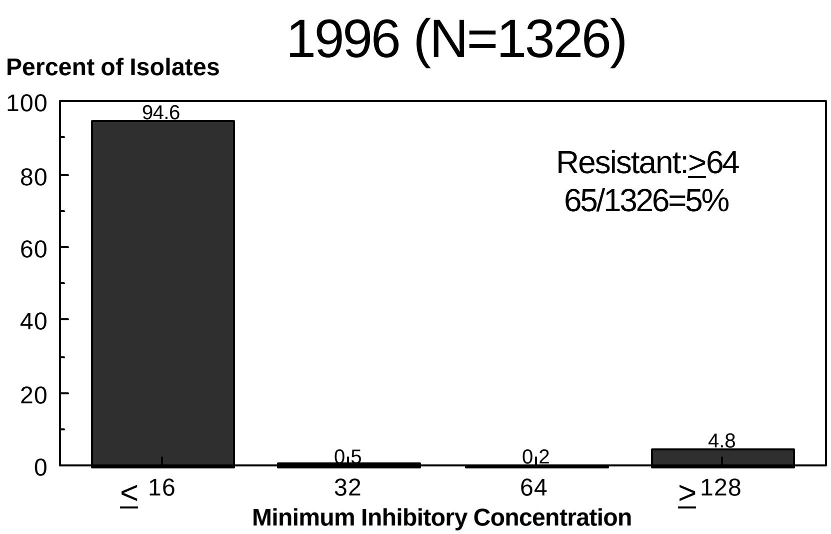
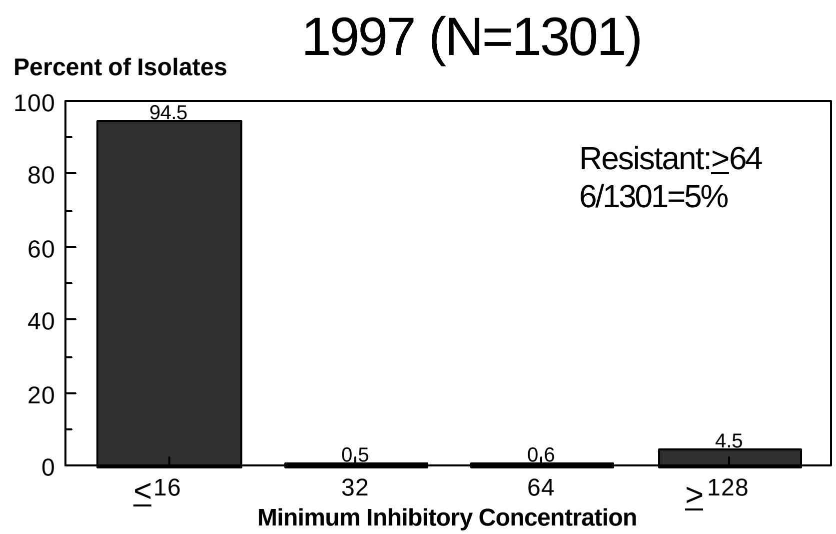
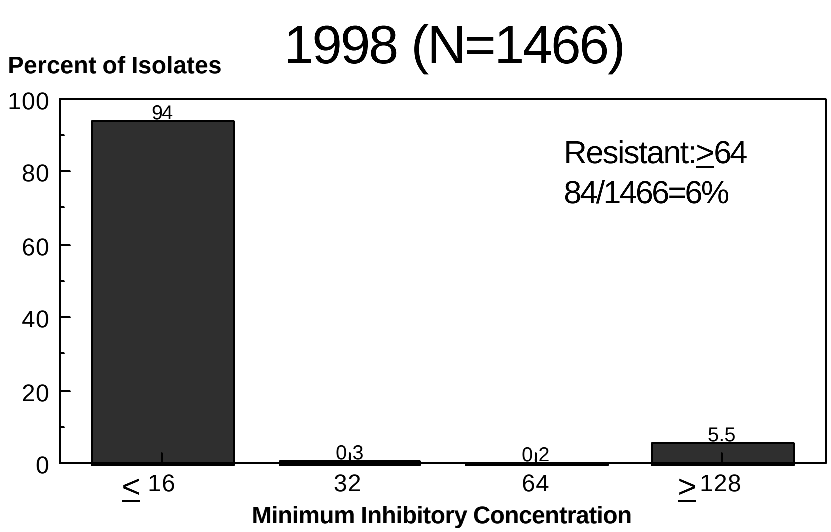
Figure 3l. MICs for Kanamycin among non-Typhi *Salmonella* isolates, 1996 - 1999







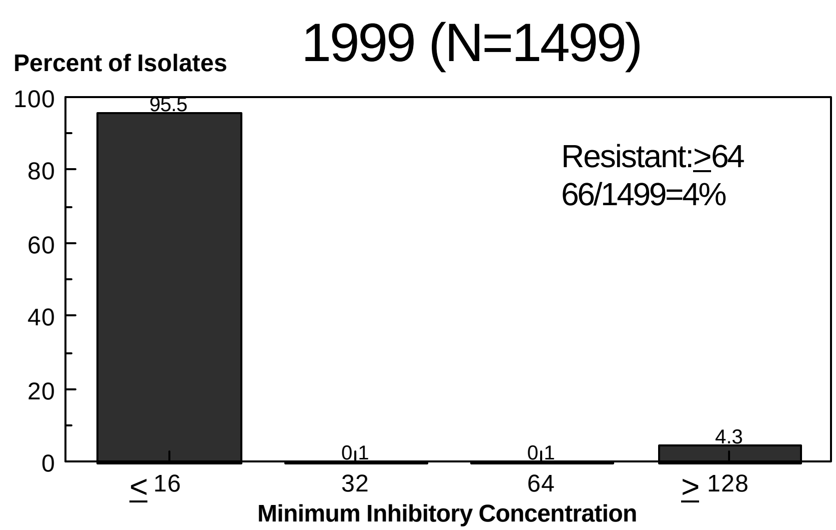


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Figure 3m. MICs for Nalidixic Acid among non-Typhi *Salmonella* isolates, 1996 - 1999

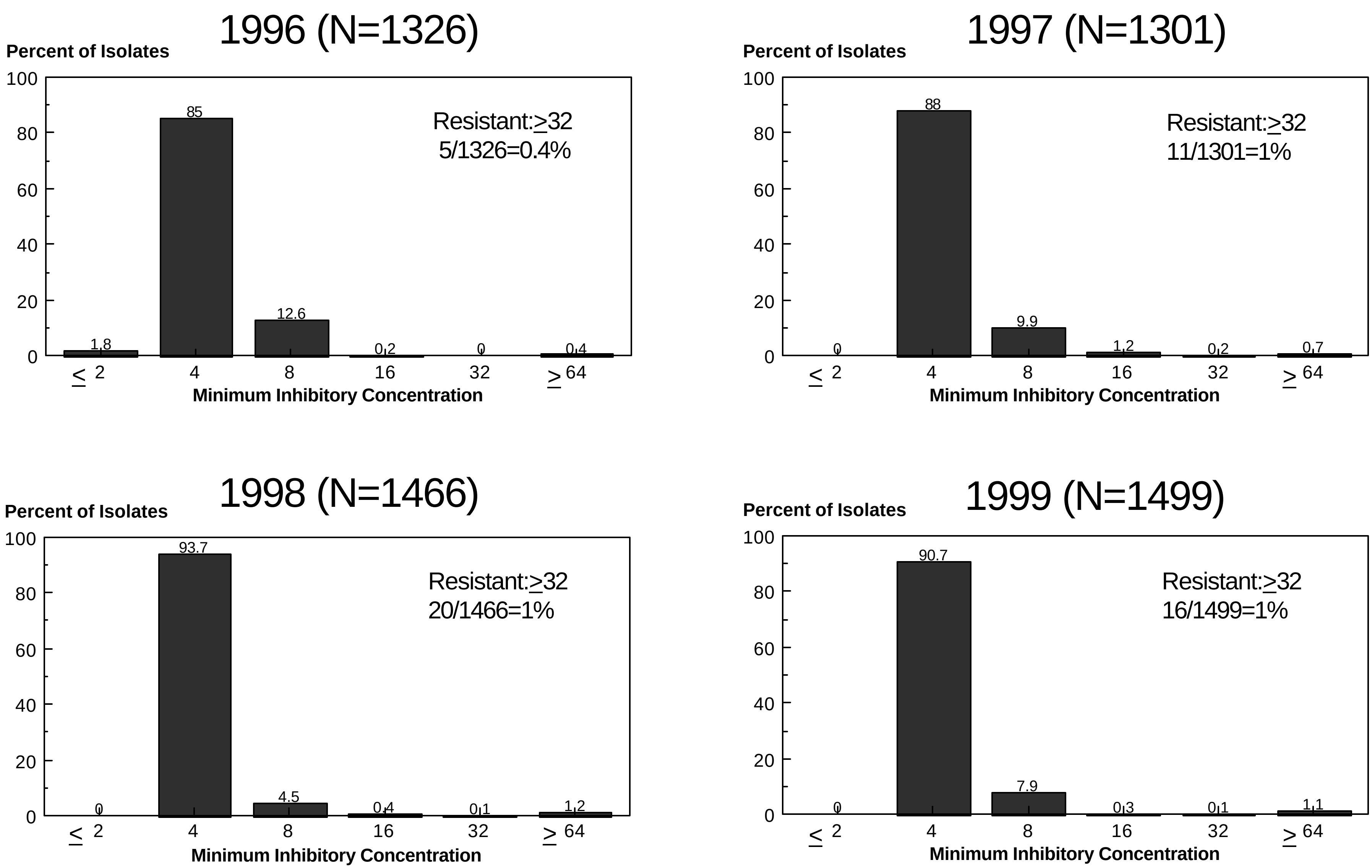

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Figure 3n. MICs for Streptomycin among non-Typhi *Salmonella* isolates, 1996 - 1999

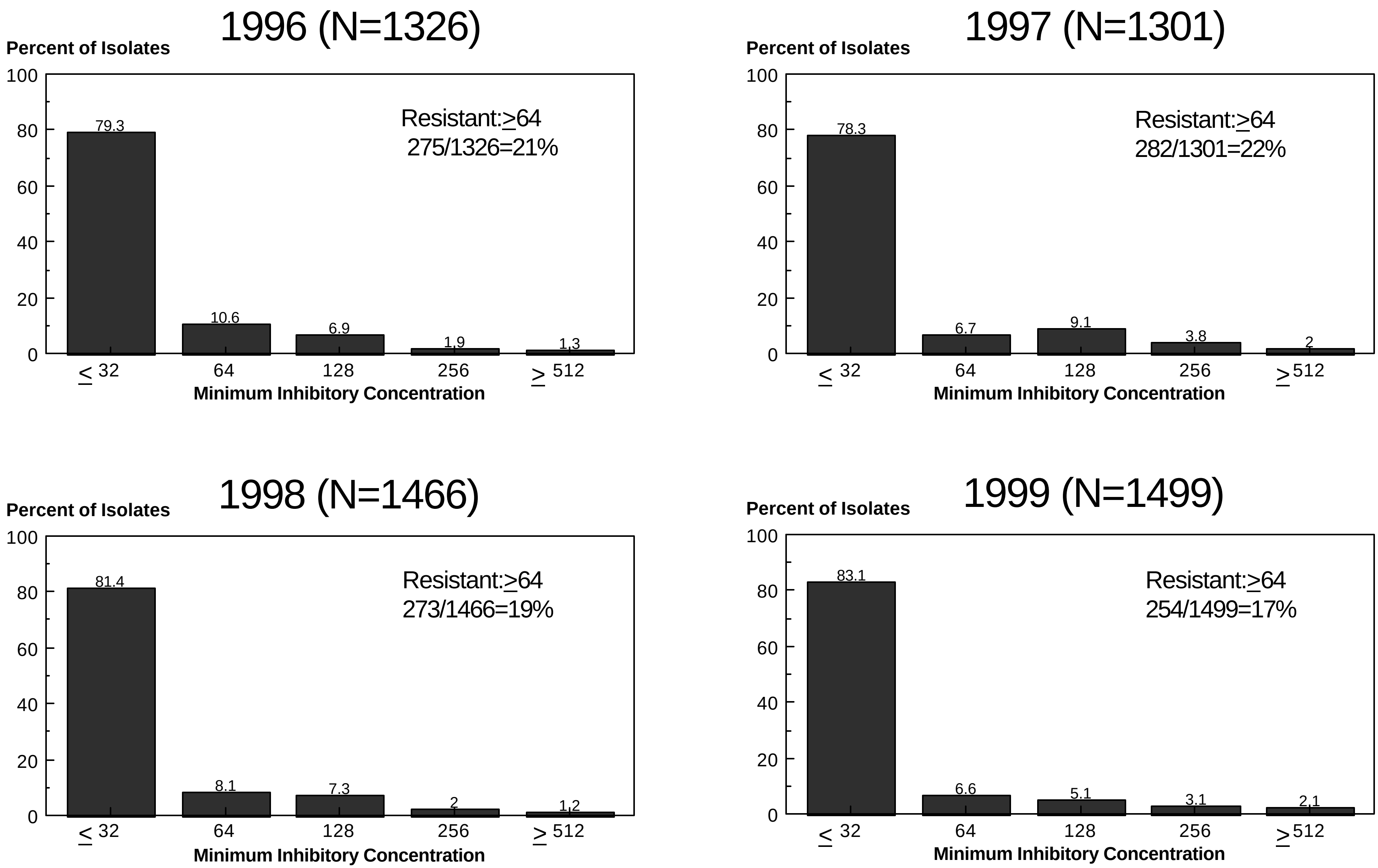

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Figure 3o. MICs for Sulfamethoxazole among non-Typhi *Salmonella* isolates, 1996 - 1999

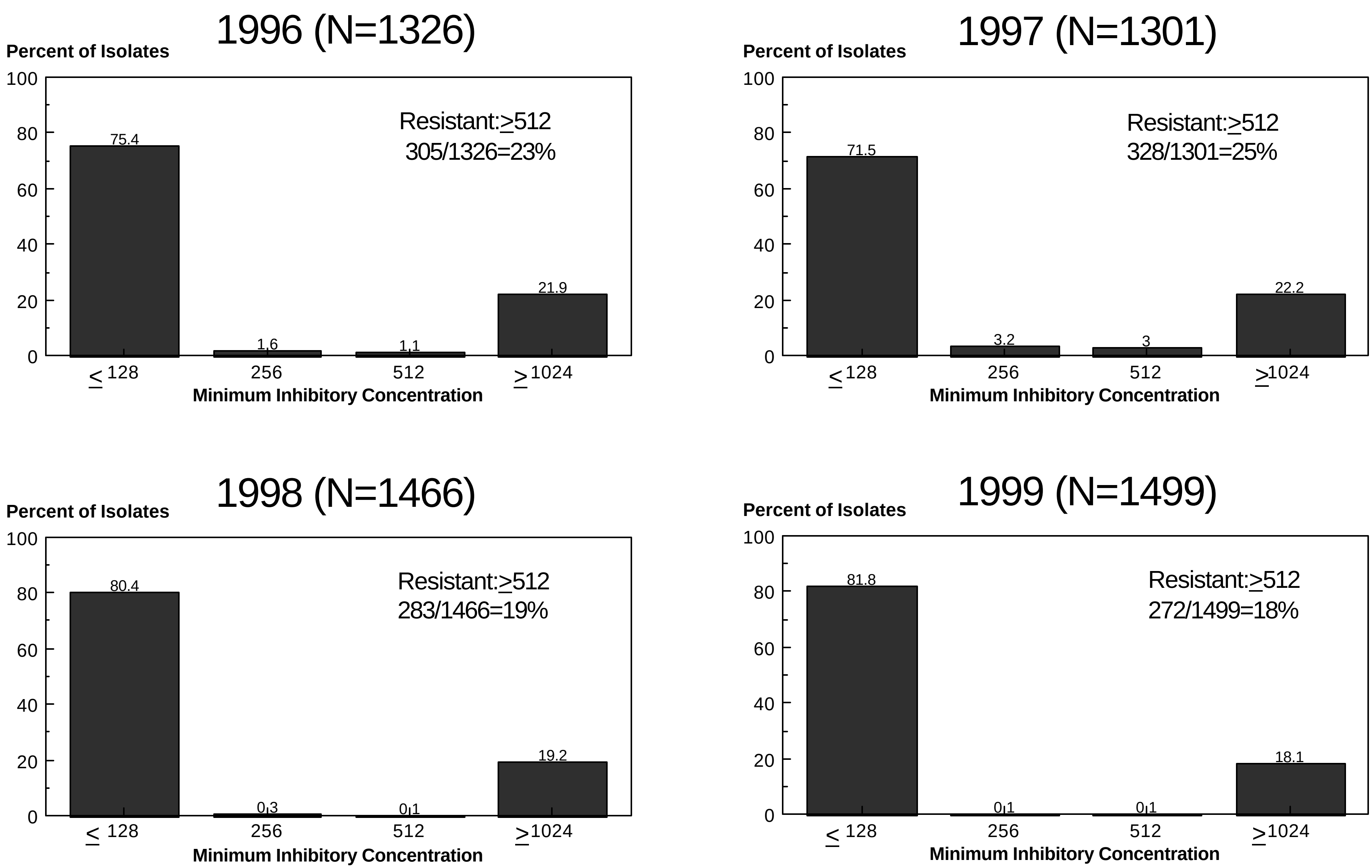

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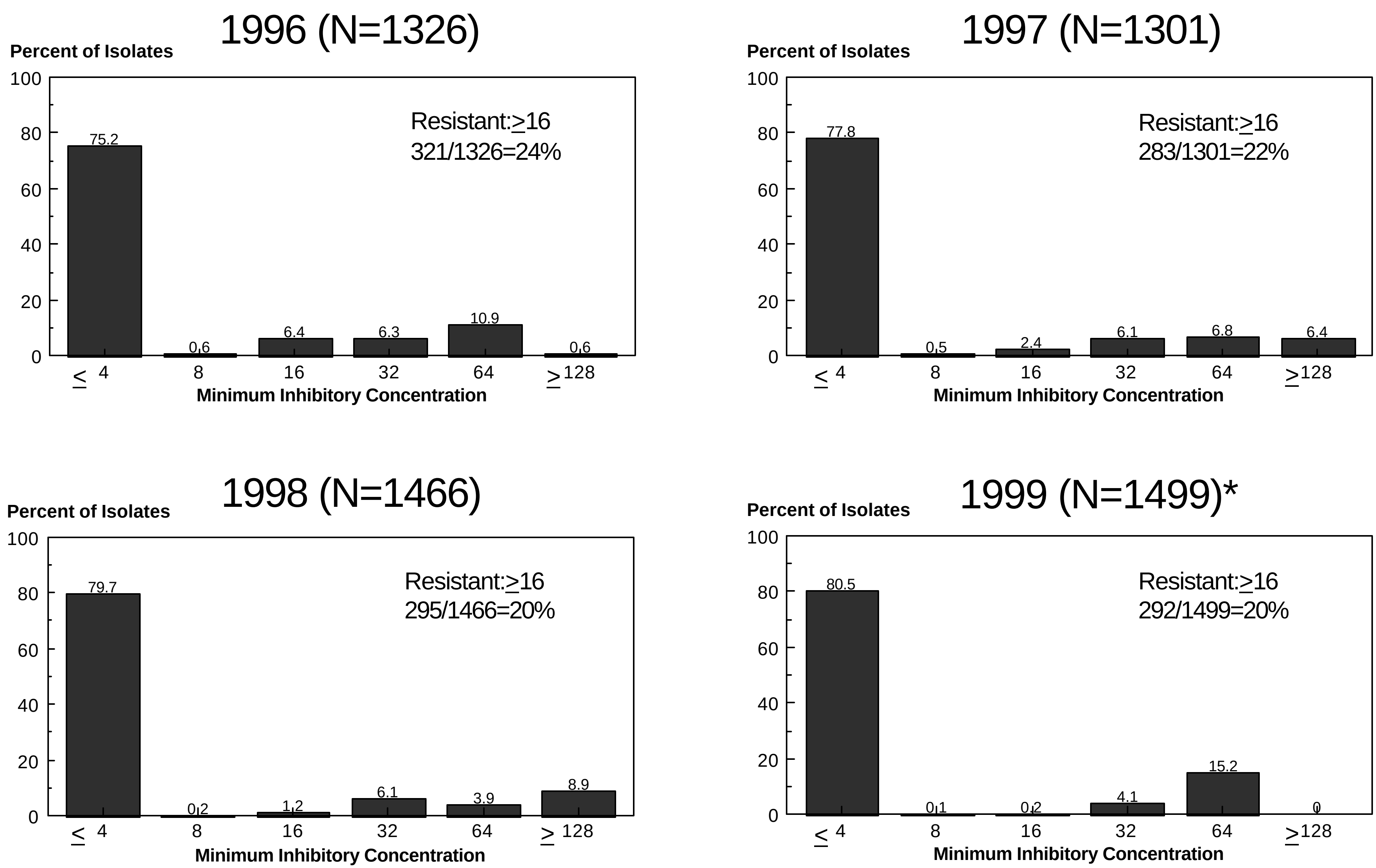
Figure 3p. MICs for Tetracycline among non-Typhi *Salmonella* isolates, 1996 - 1999



* Maximum MIC dilution for 1999 was 32 ug/ml. All resistant isolates had a MIC >32 ug/ml.

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Figure 3q. MICs for Trimethoprim-Sulfamethoxazole among non-Typhi *Salmonella* isolates, 1996 - 1999

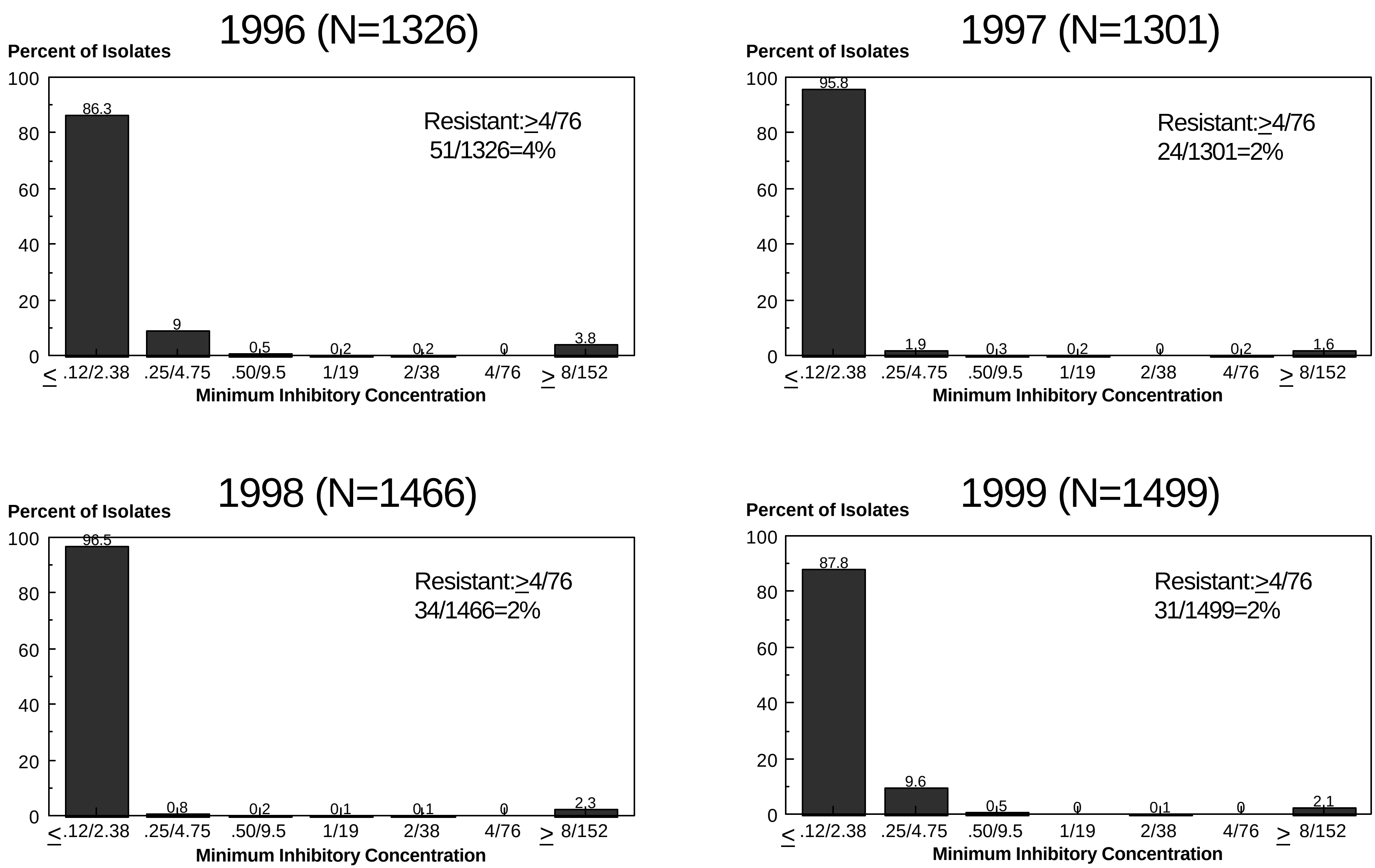

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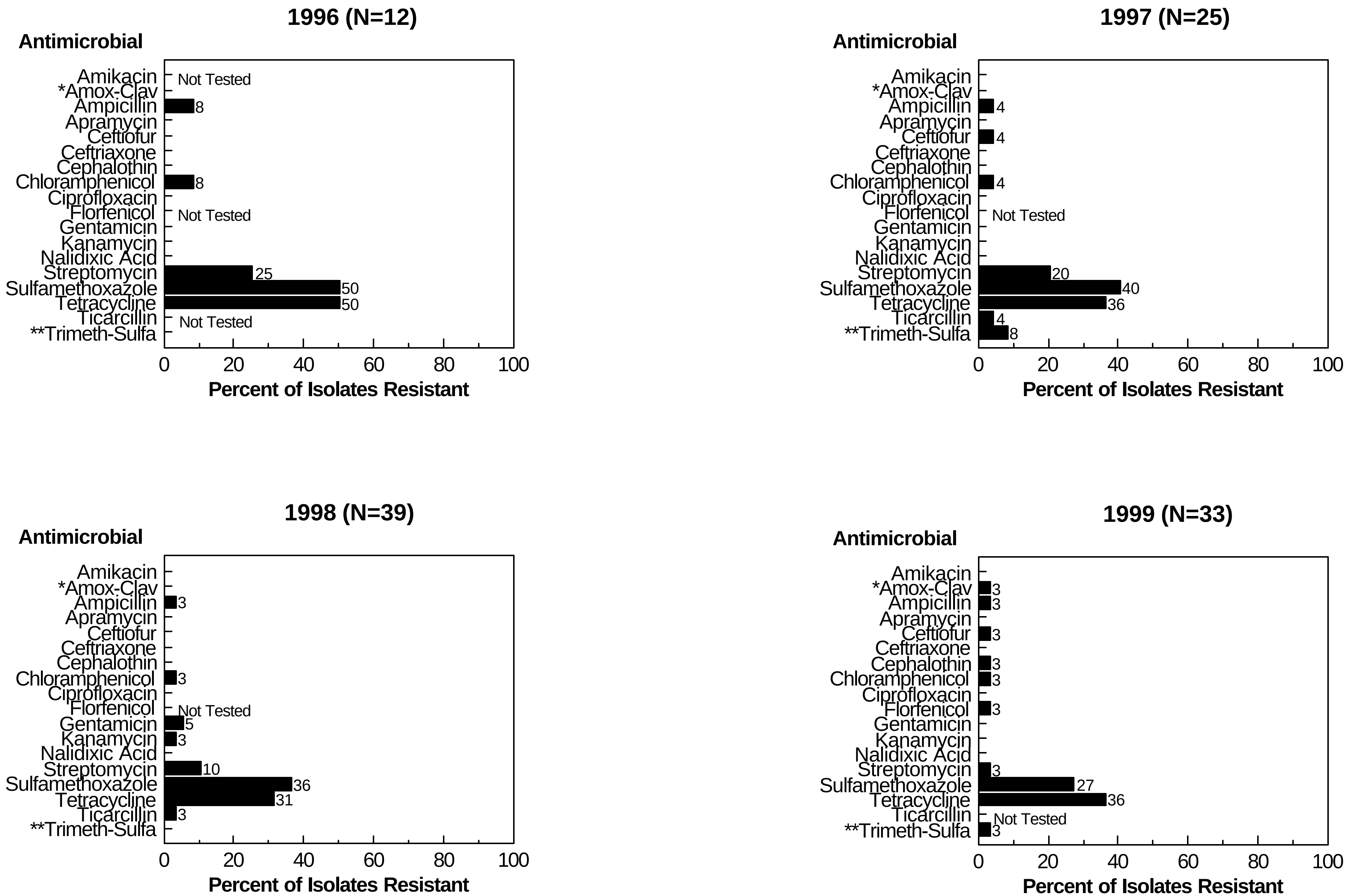
Figure 4a. Resistance among *Salmonella* serotype Agona isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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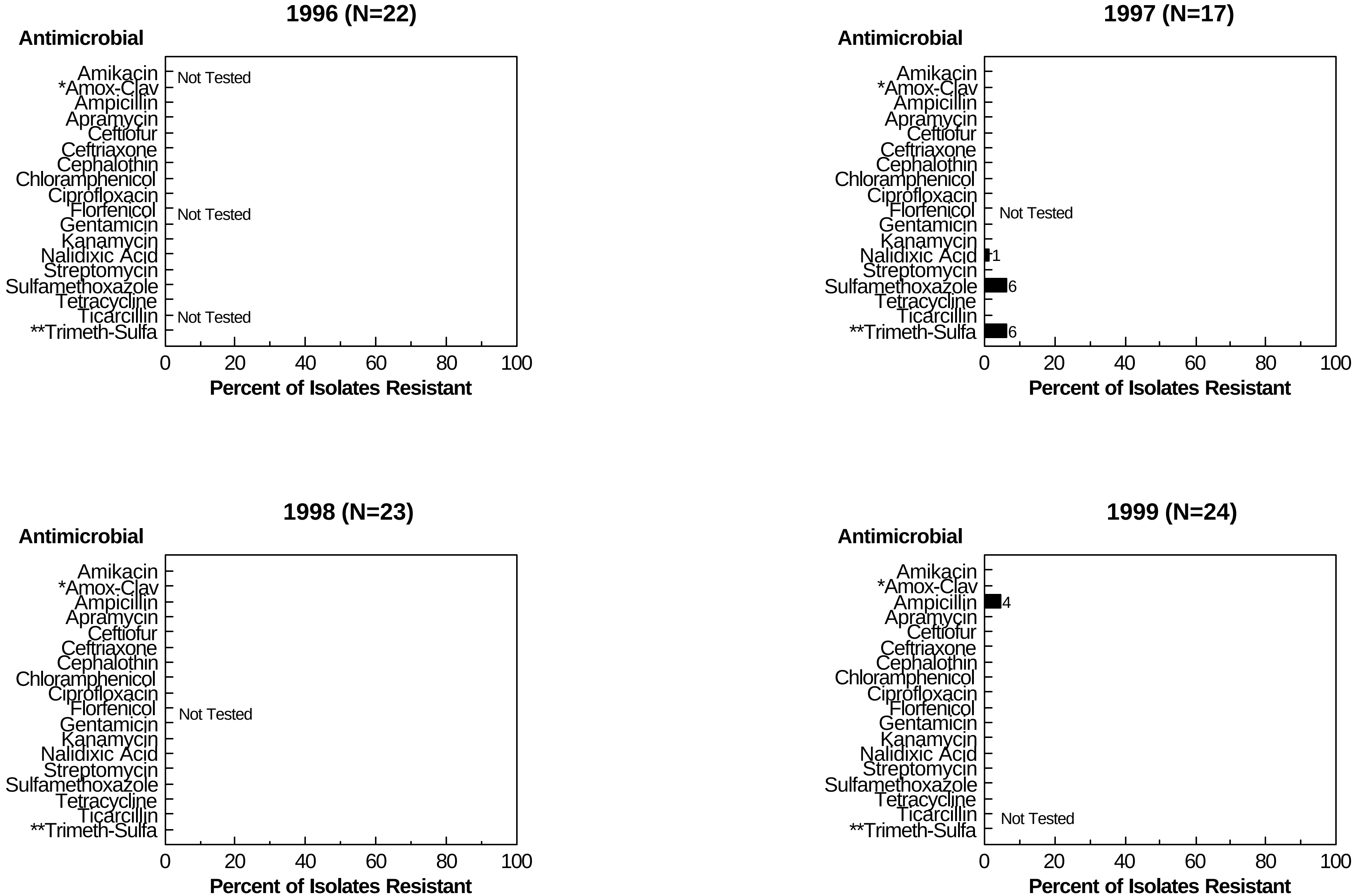
Figure 4b. Resistance among *Salmonella* serotype Braenderup isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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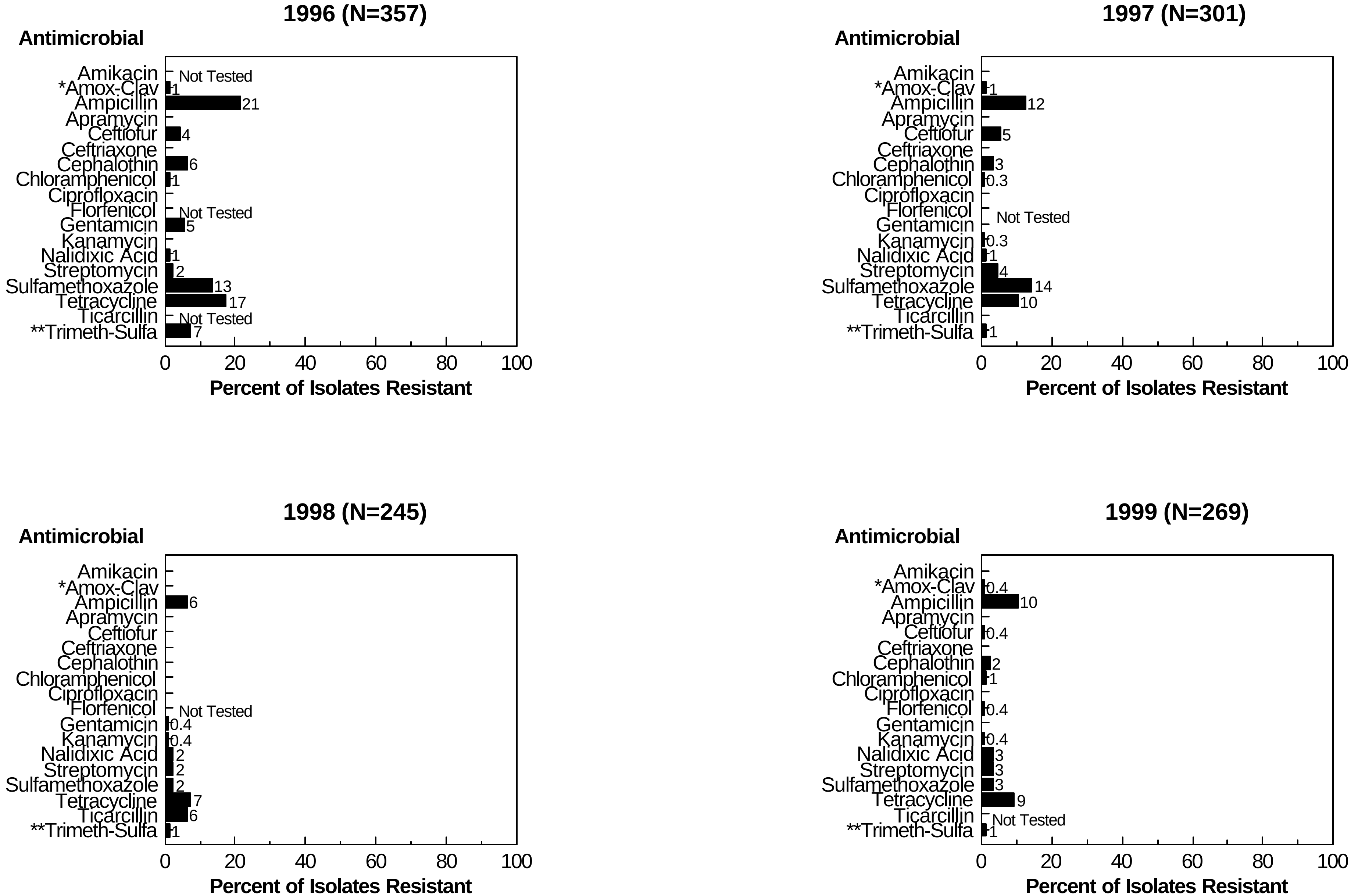
Figure 4c. Resistance among *Salmonella* serotype Enteritidis isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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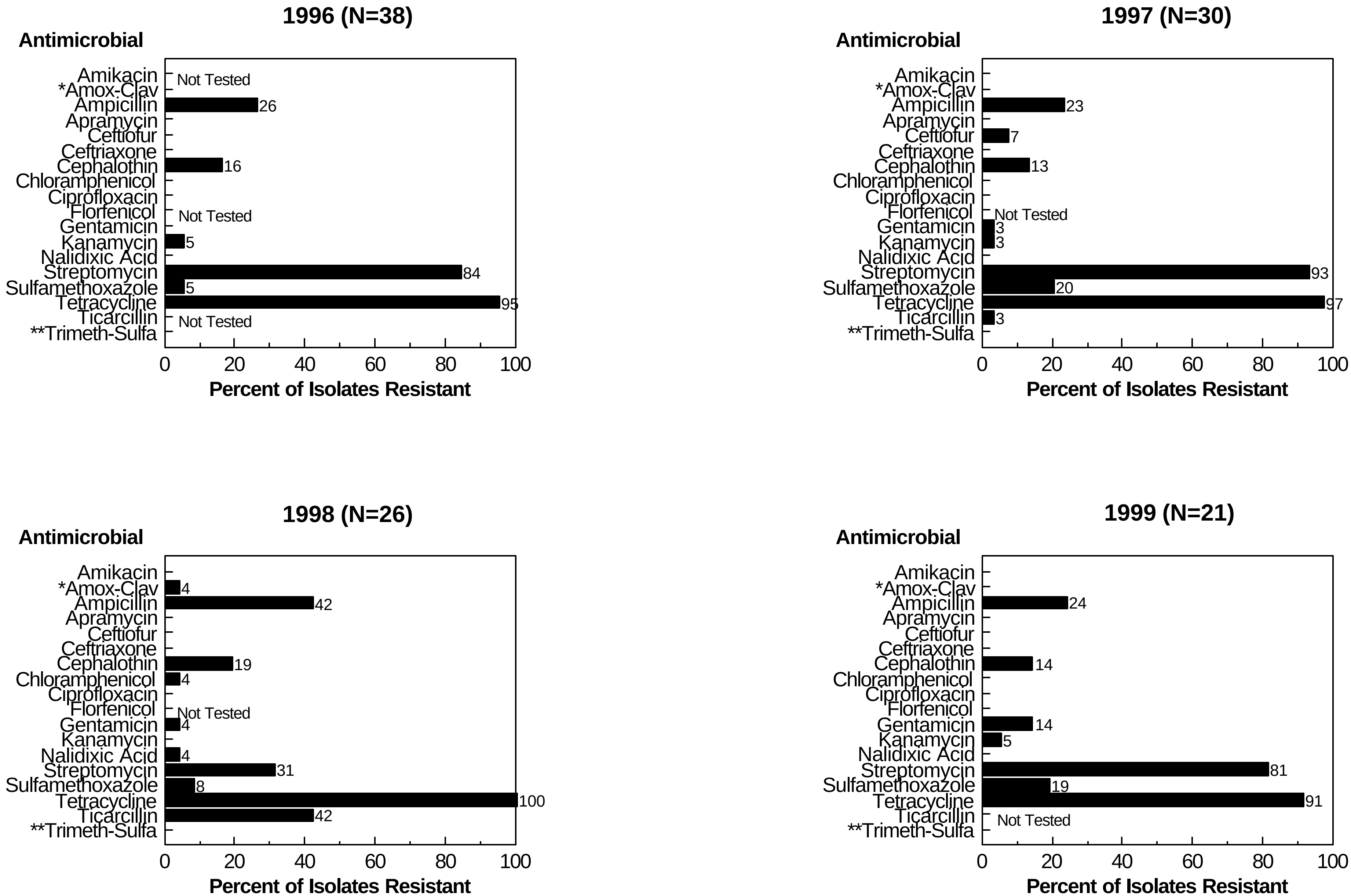
Figure 4d. Resistance among *Salmonella* serotype Hadar isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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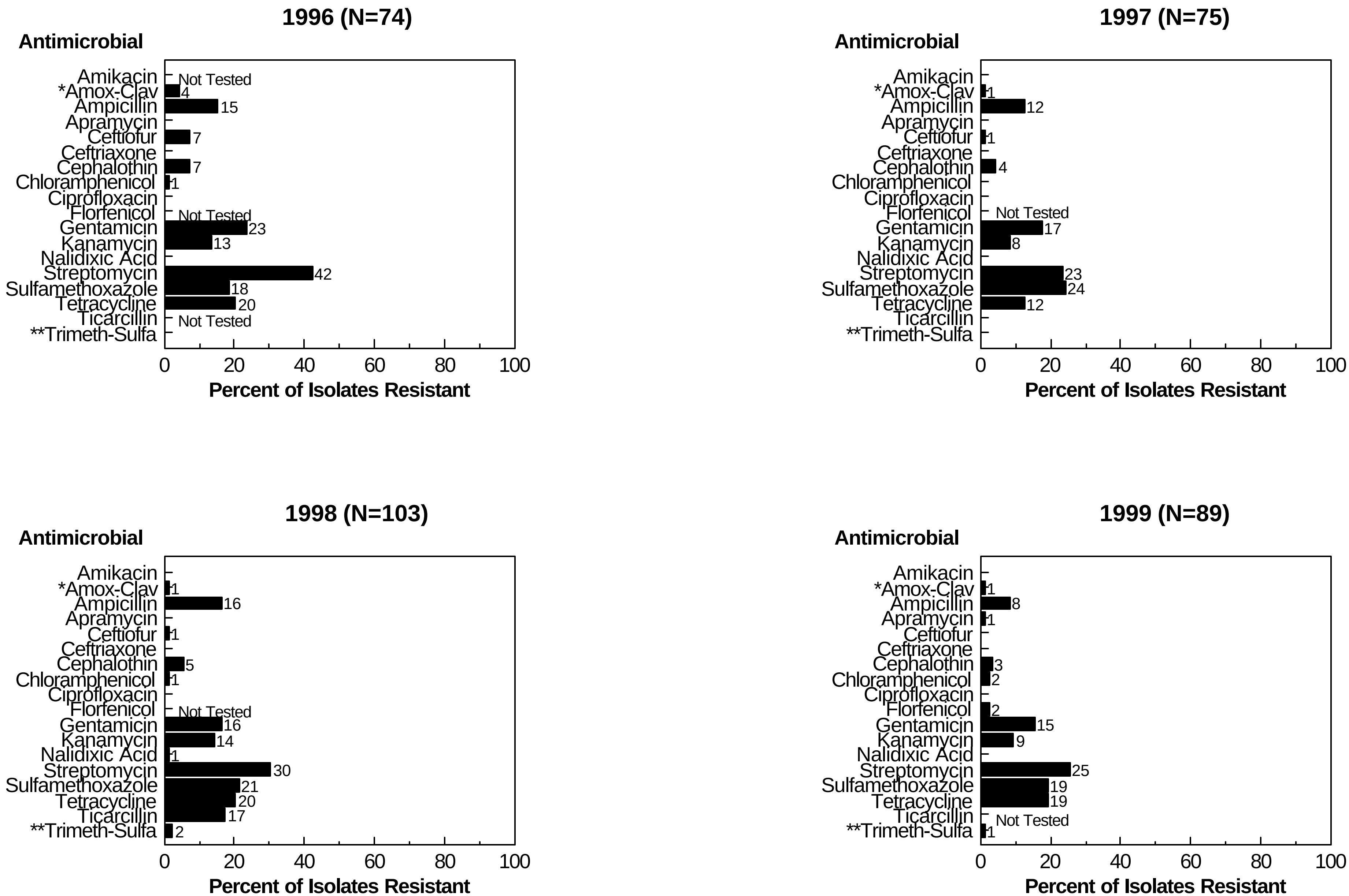
Figure 4e. Resistance among *Salmonella* serotype Heidelberg isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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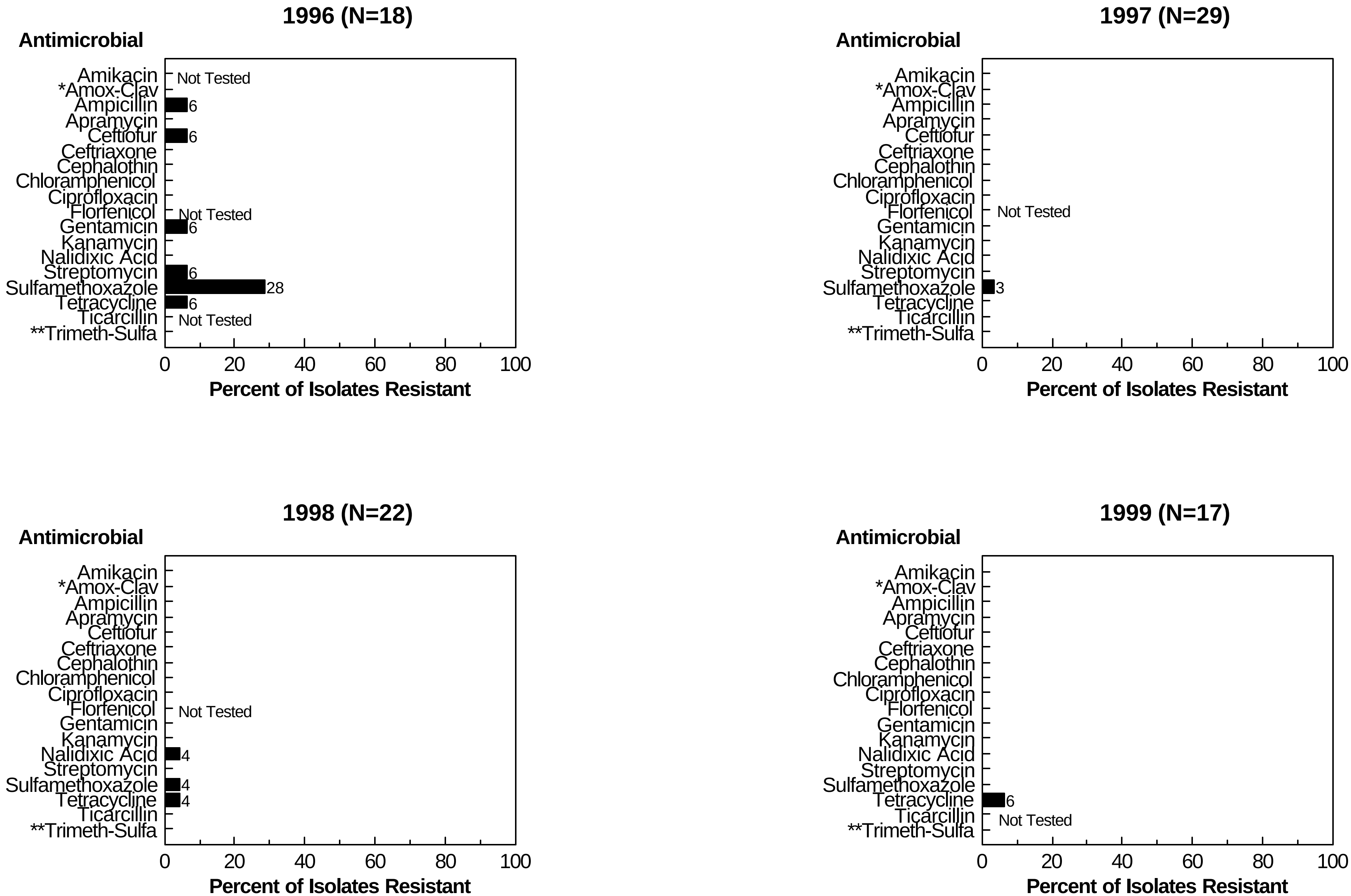
Figure 4f. Resistance among *Salmonella* serotype Infantis isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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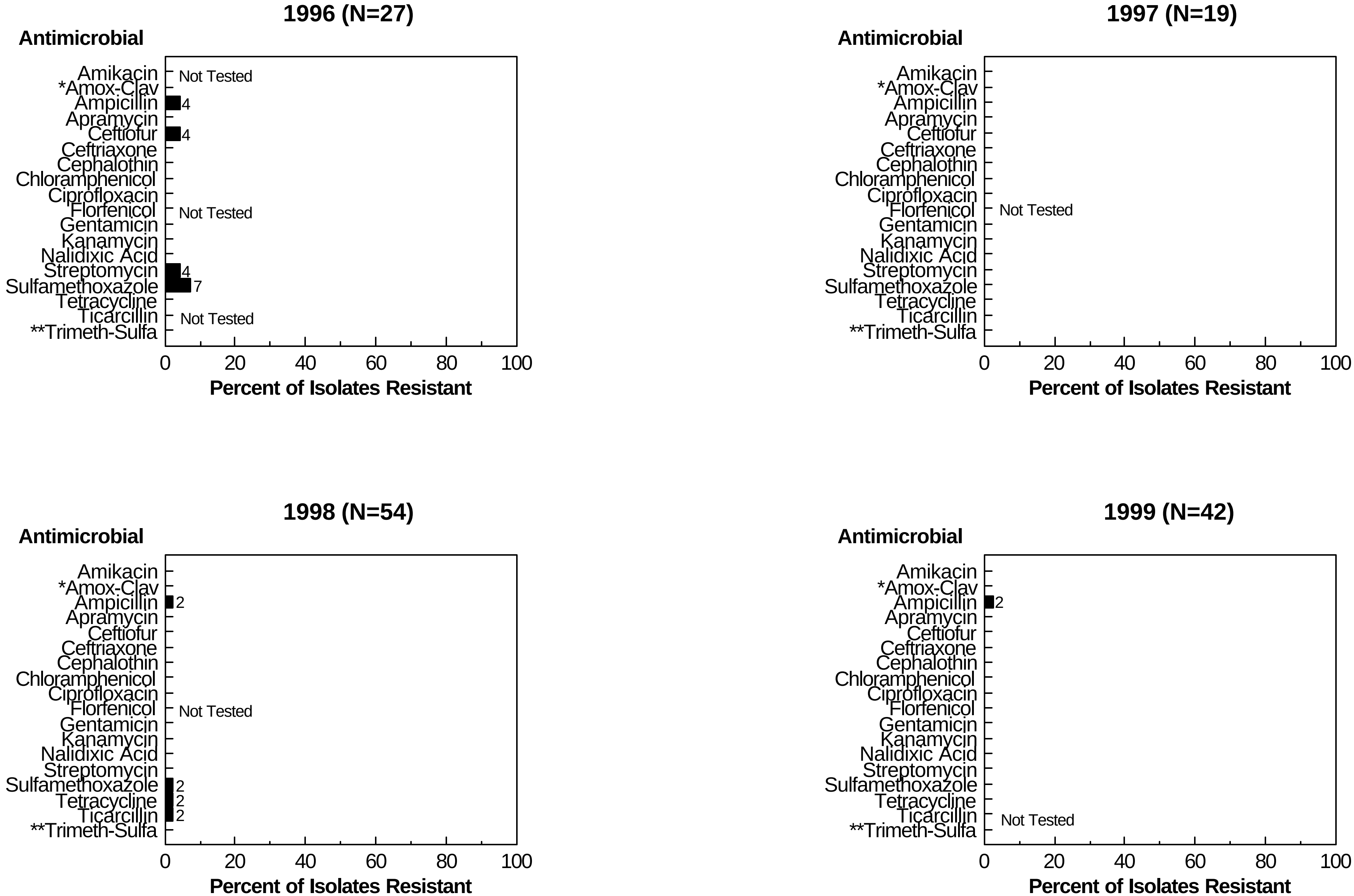
Figure 4g. Resistance among *Salmonella* serotype Javiana isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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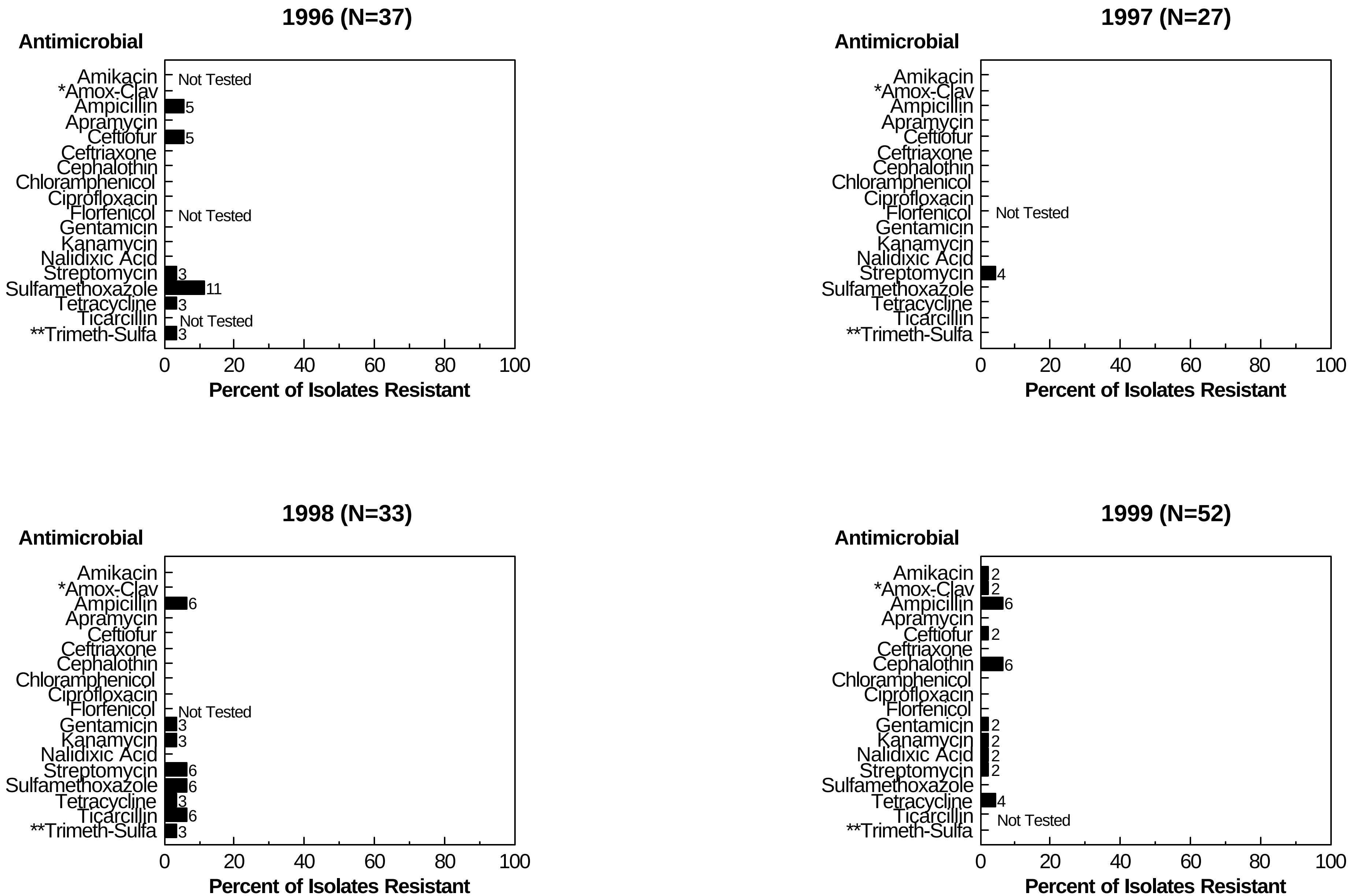
Figure 4h. Resistance among *Salmonella* serotype Montevideo isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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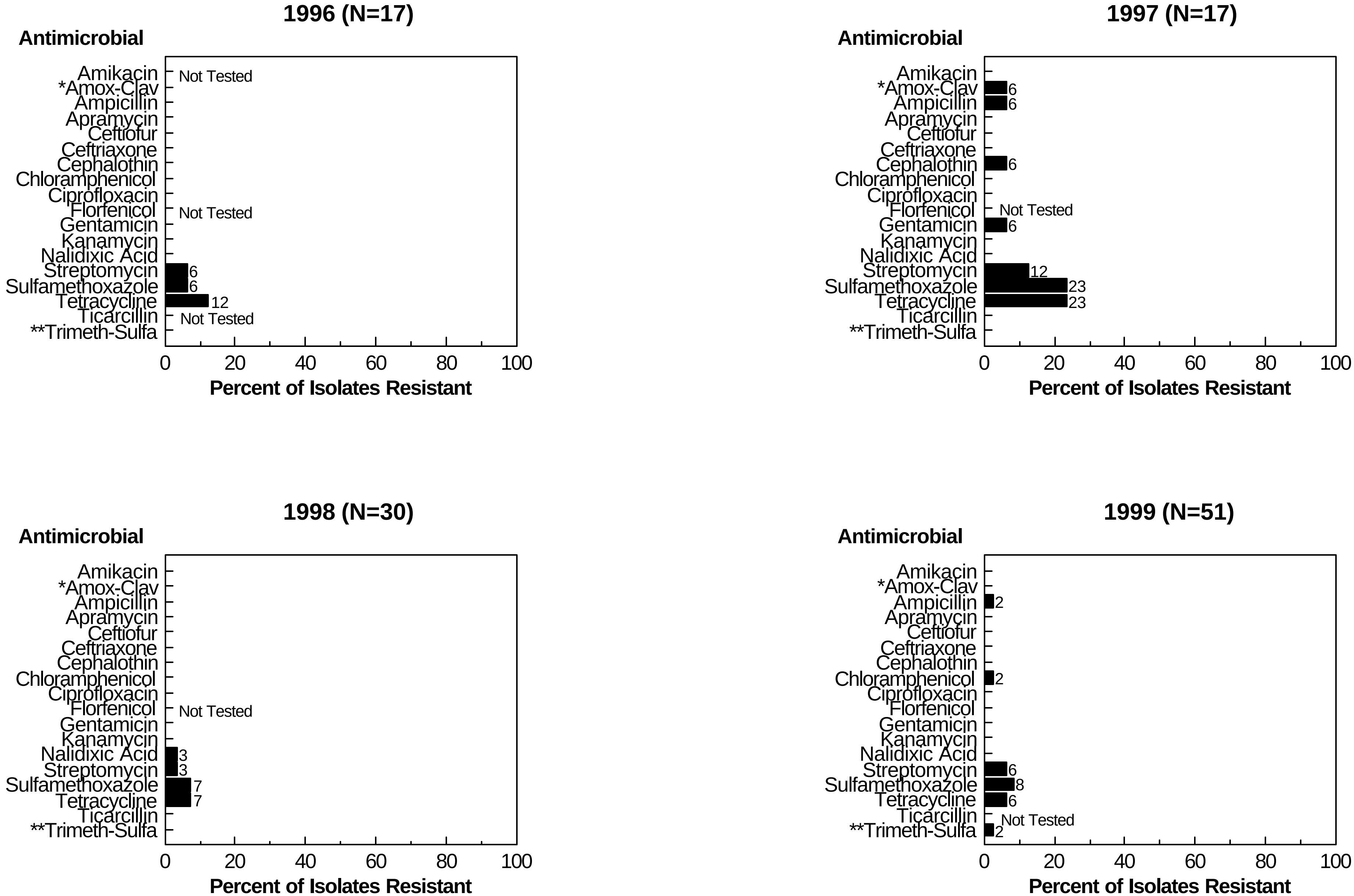
Figure 4i. Resistance among *Salmonella* serotype Muenchen isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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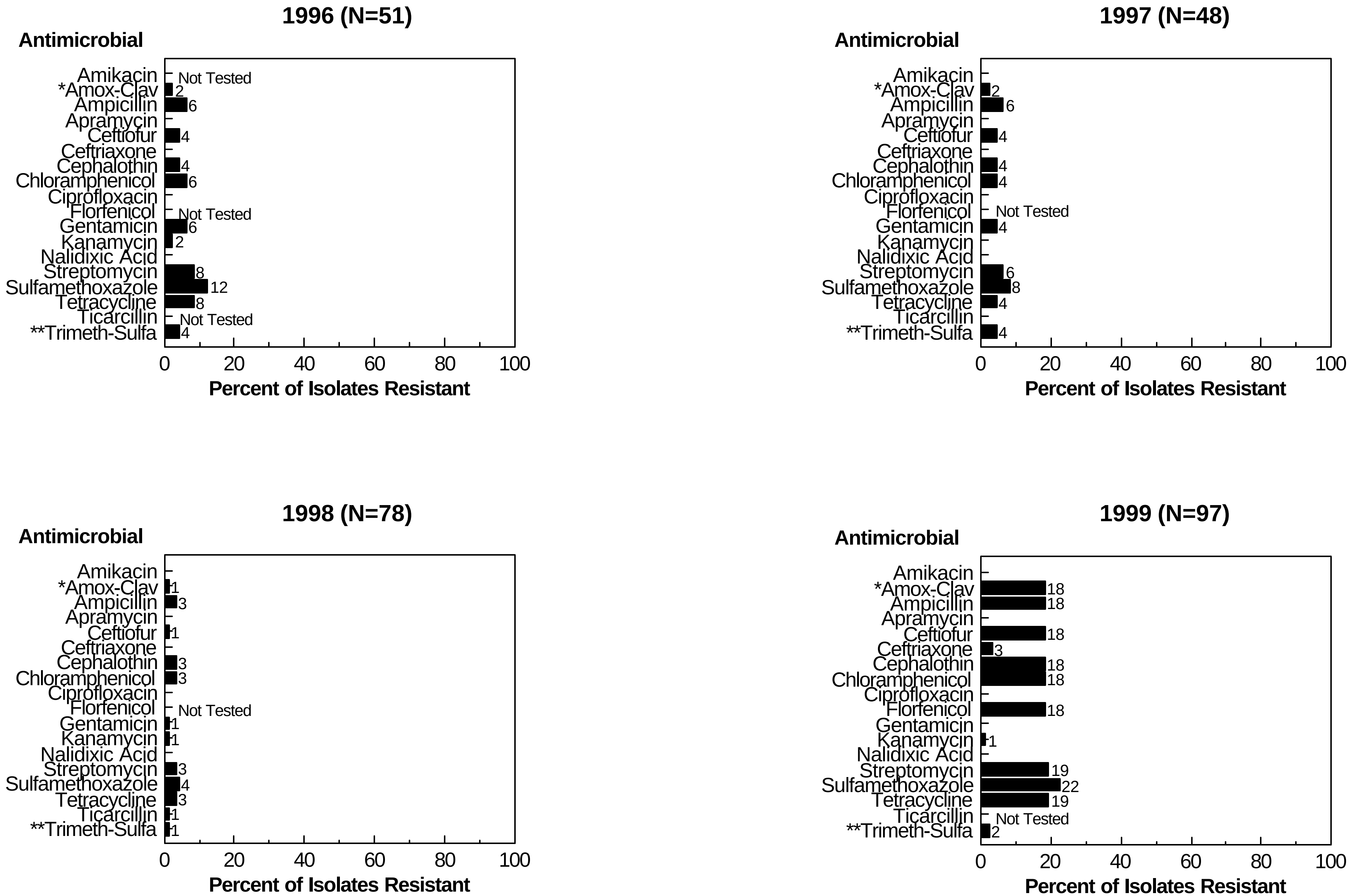
Figure 4j. Resistance among *Salmonella* serotype Newport isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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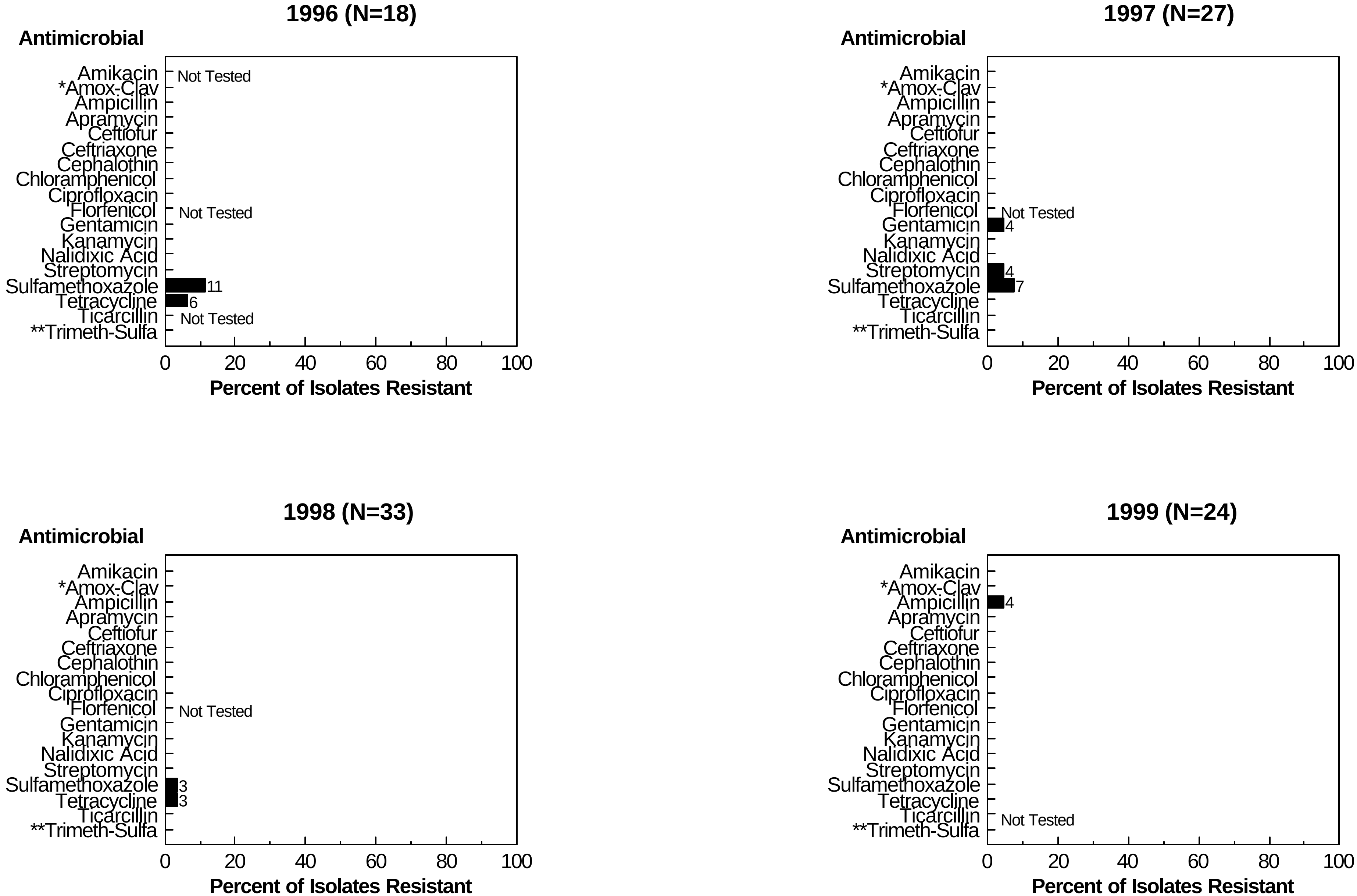
Figure 4k. Resistance among *Salmonella* serotype Oranienburg isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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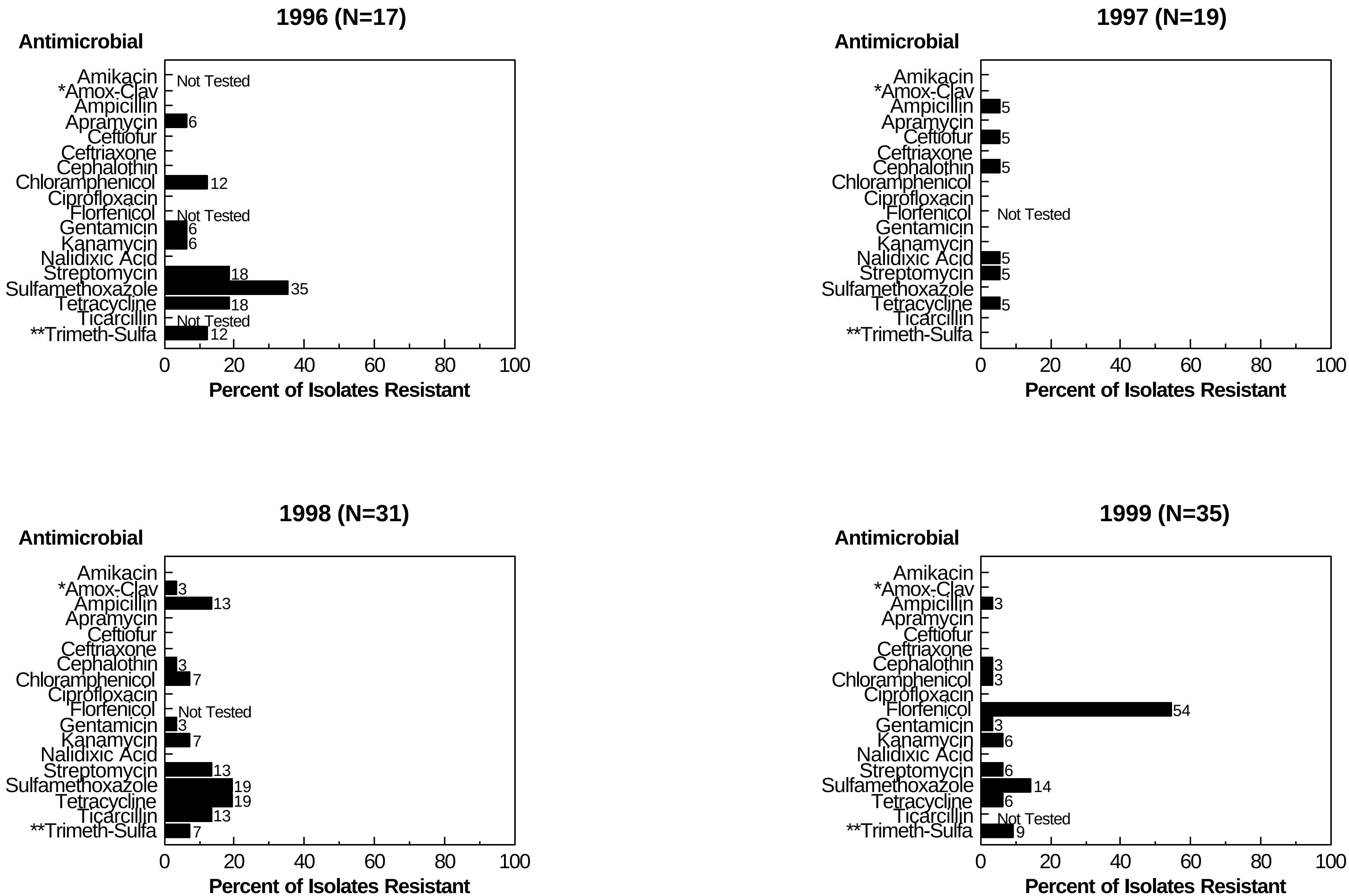
Figure 4l. Resistance among *Salmonella* serotype Saint Paul isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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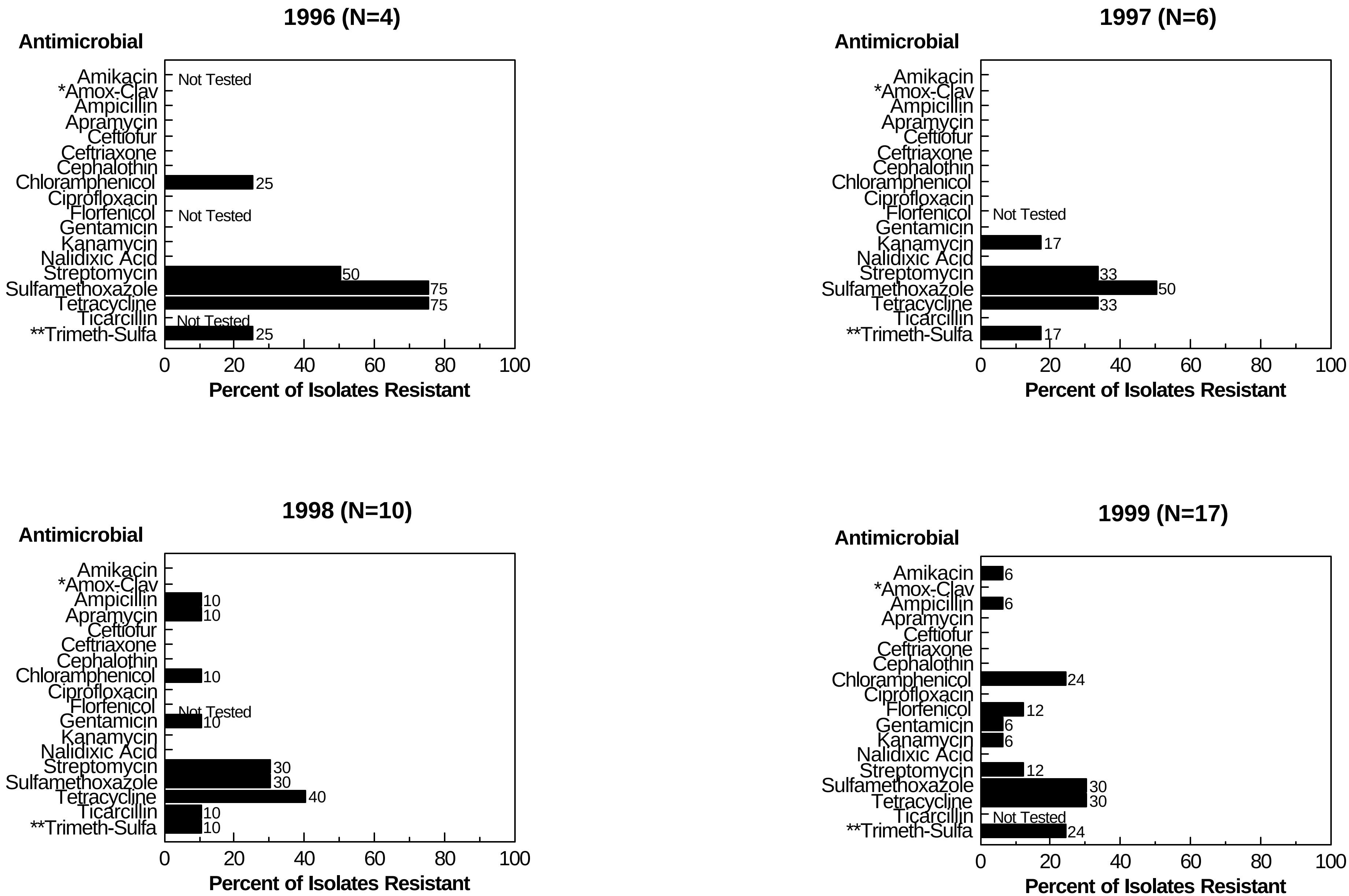
Figure 4m. Resistance among *Salmonella* serotype Stanley isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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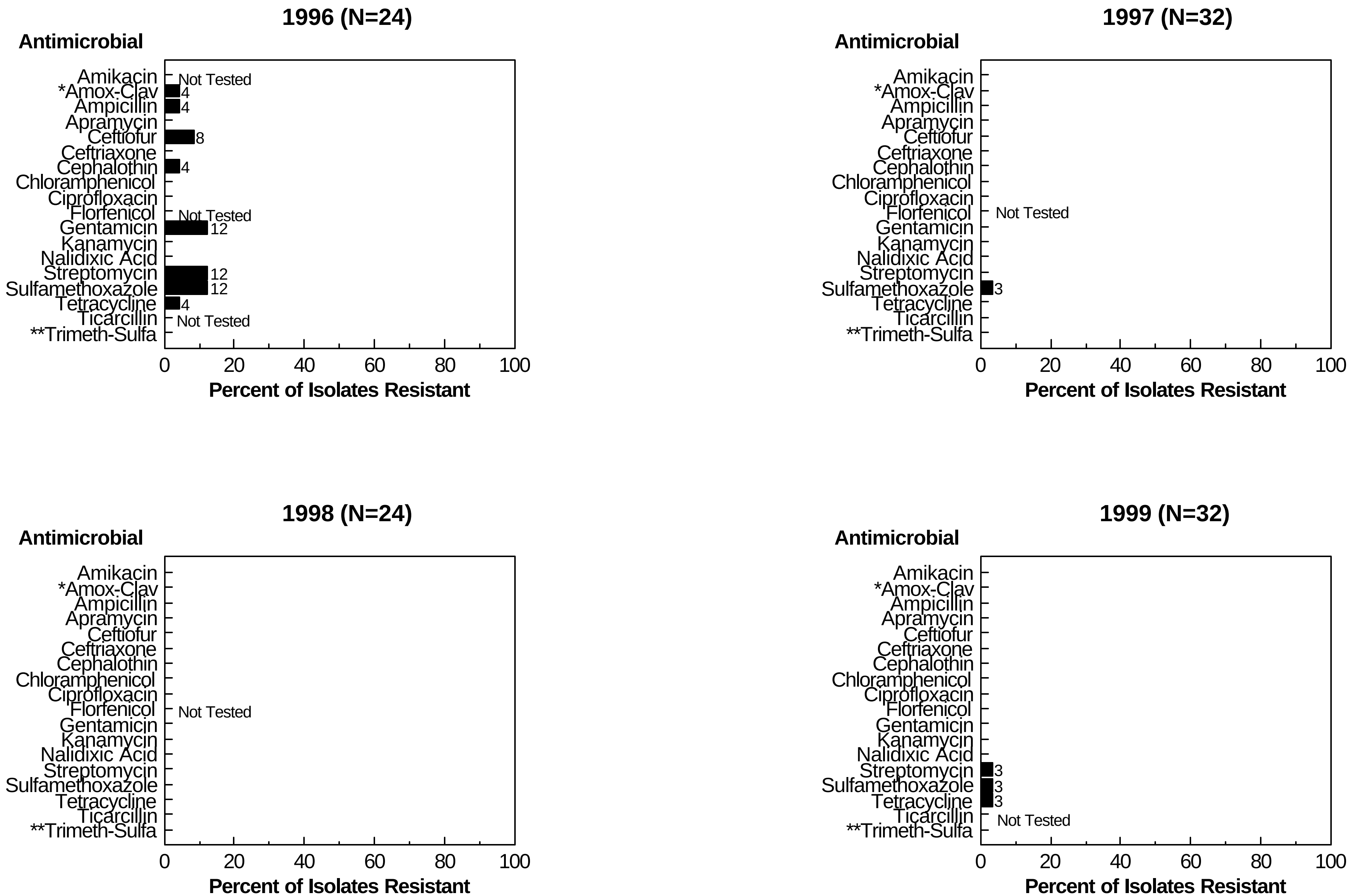
Figure 4n. Resistance among *Salmonella* serotype Thompson isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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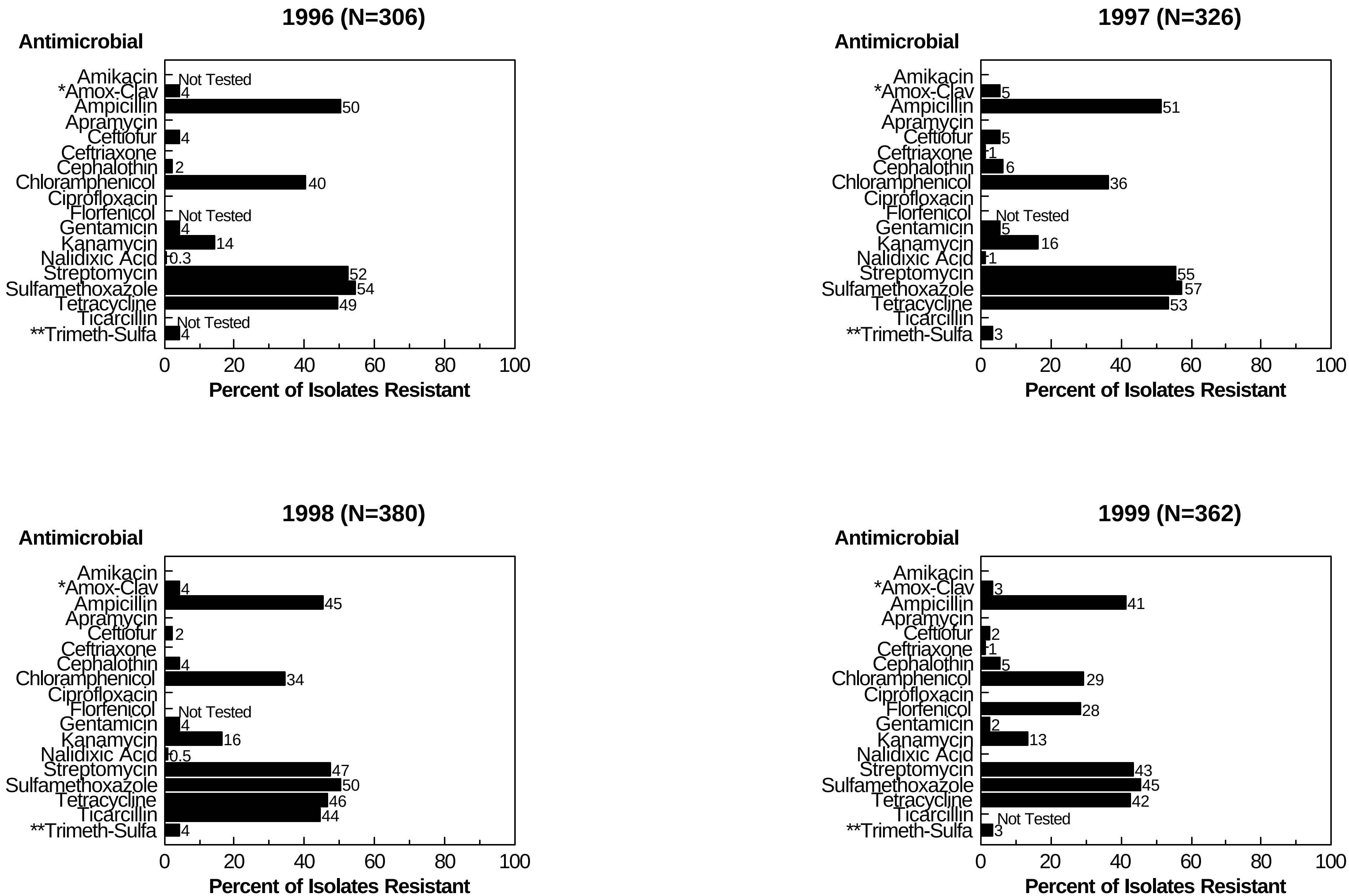
Figure 4o. Resistance among *Salmonella* serotype Typhimurium isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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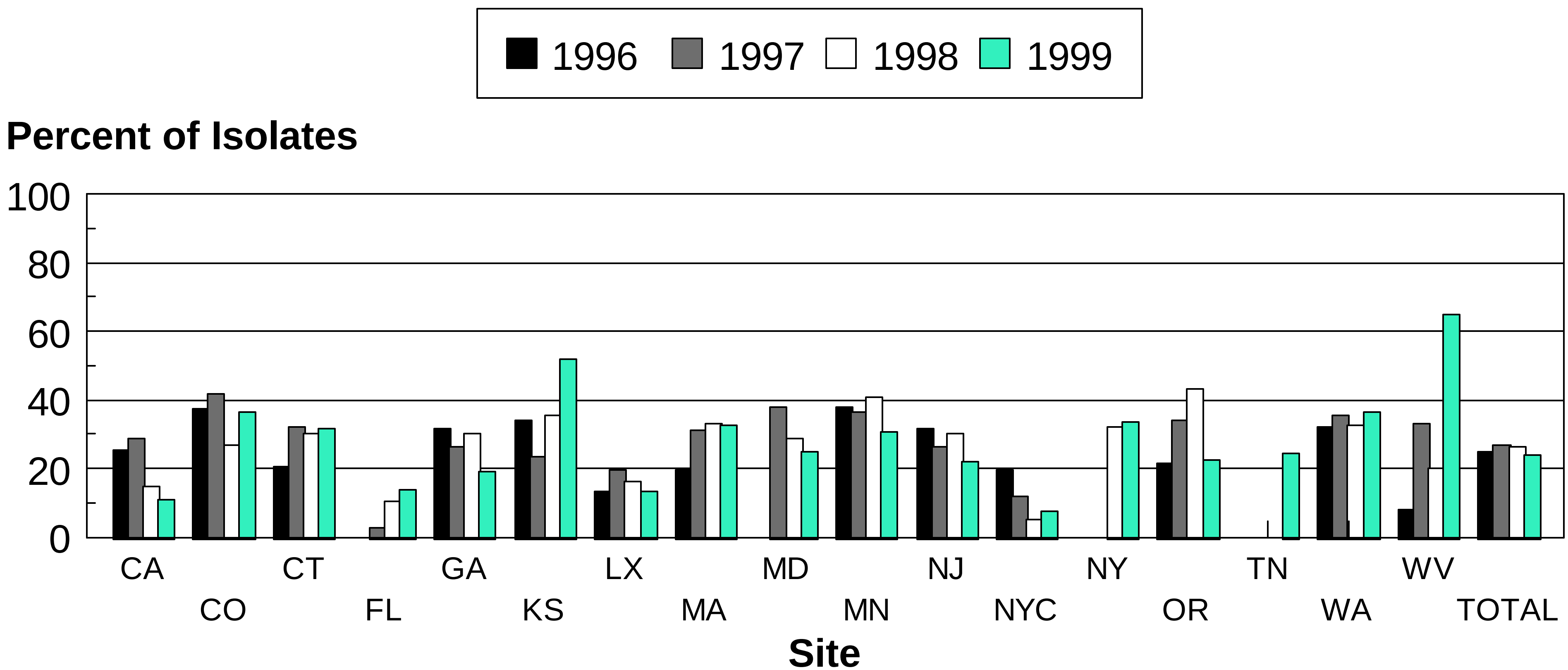
Figure 5. Percent of non-Typhi *Salmonella* isolates that are serotype Typhimurium, by site, 1996 - 1999



Percent Typhimurium for all sites:

1996 - 306/1326 = 23%   1997 - 326/1301 = 25%

1998 - 380/1466 = 26%   1999 - 362/1499 = 24%

LX=Los Angeles County   NYC=New York City

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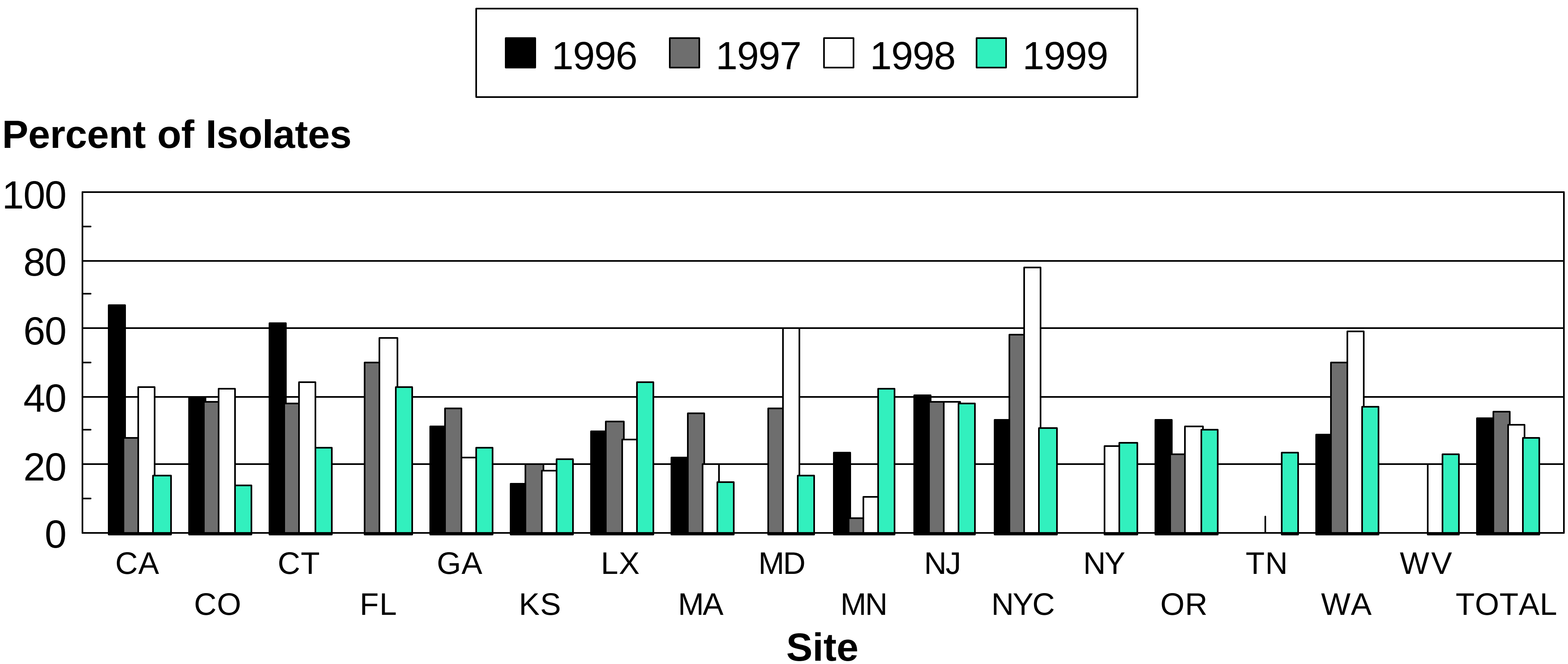
Figure 6. Percent of *Salmonella* Typhimurium isolates that are resistant to Ampicillin, Chloramphenicol, Streptomycin, Sulfamethoxazole, and Tetracycline (ACSSuT), by site, 1996-1999



Percent Typhimurium with ACSSuT pattern for all sites:
1996 - 103/306 = 34%   1997 - 115/326 = 35%
1998 - 120/380 = 32%   1999 - 102/362 = 28%

LX=Los Angeles County   NYC=New York City

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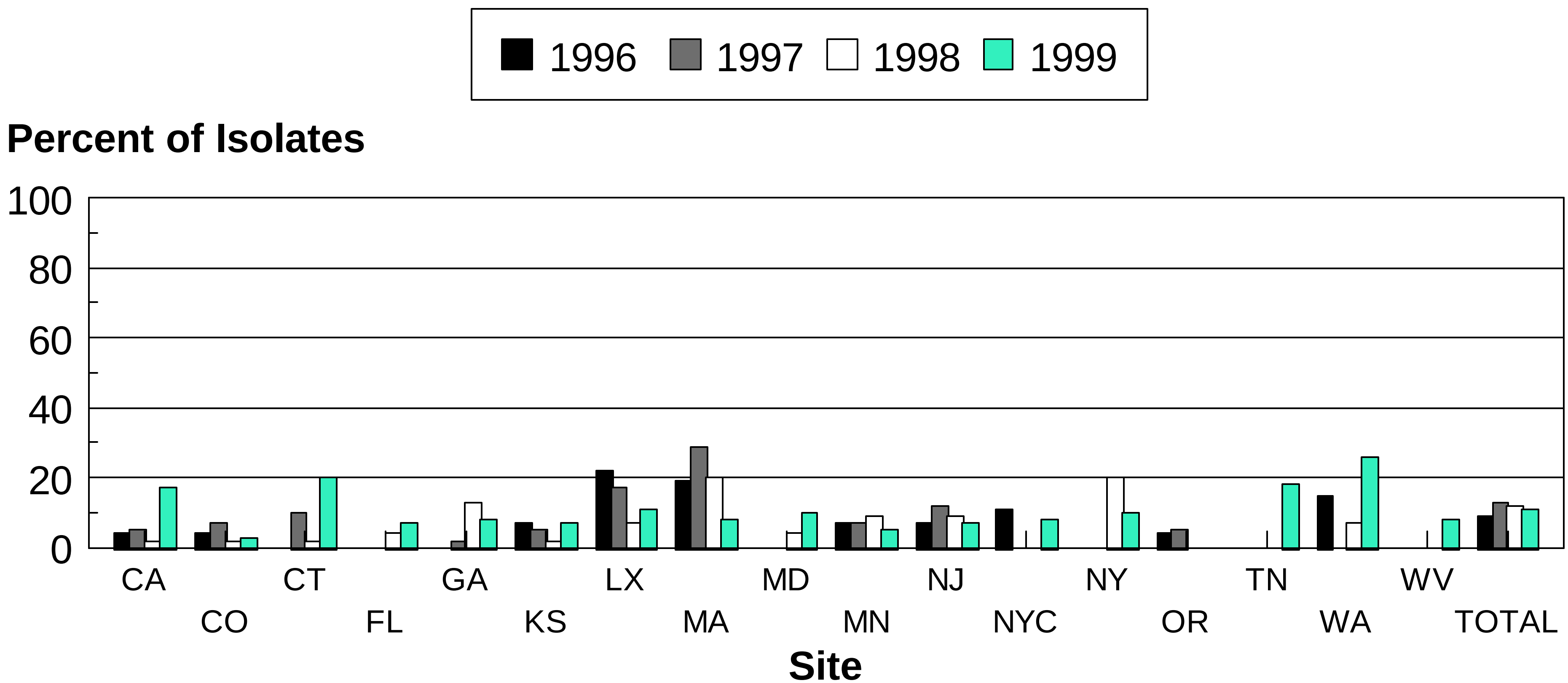
Figure 7. Percent of *Salmonella* Typhimurium isolates that are resistant to Ampicillin, Kanamycin, Streptomycin, Sulfamethoxazole, and Tetracycline (AKSSuT), by site, 1996-1999



Percent Typhimurium with AKSSuT pattern for all sites:

1996 - 27/306 = 9%   1997 - 41/326 = 13%

1998 - 46/374 = 12%   1999 - 39/362 = 11%

LX=Los Angeles County   NYC=New York City

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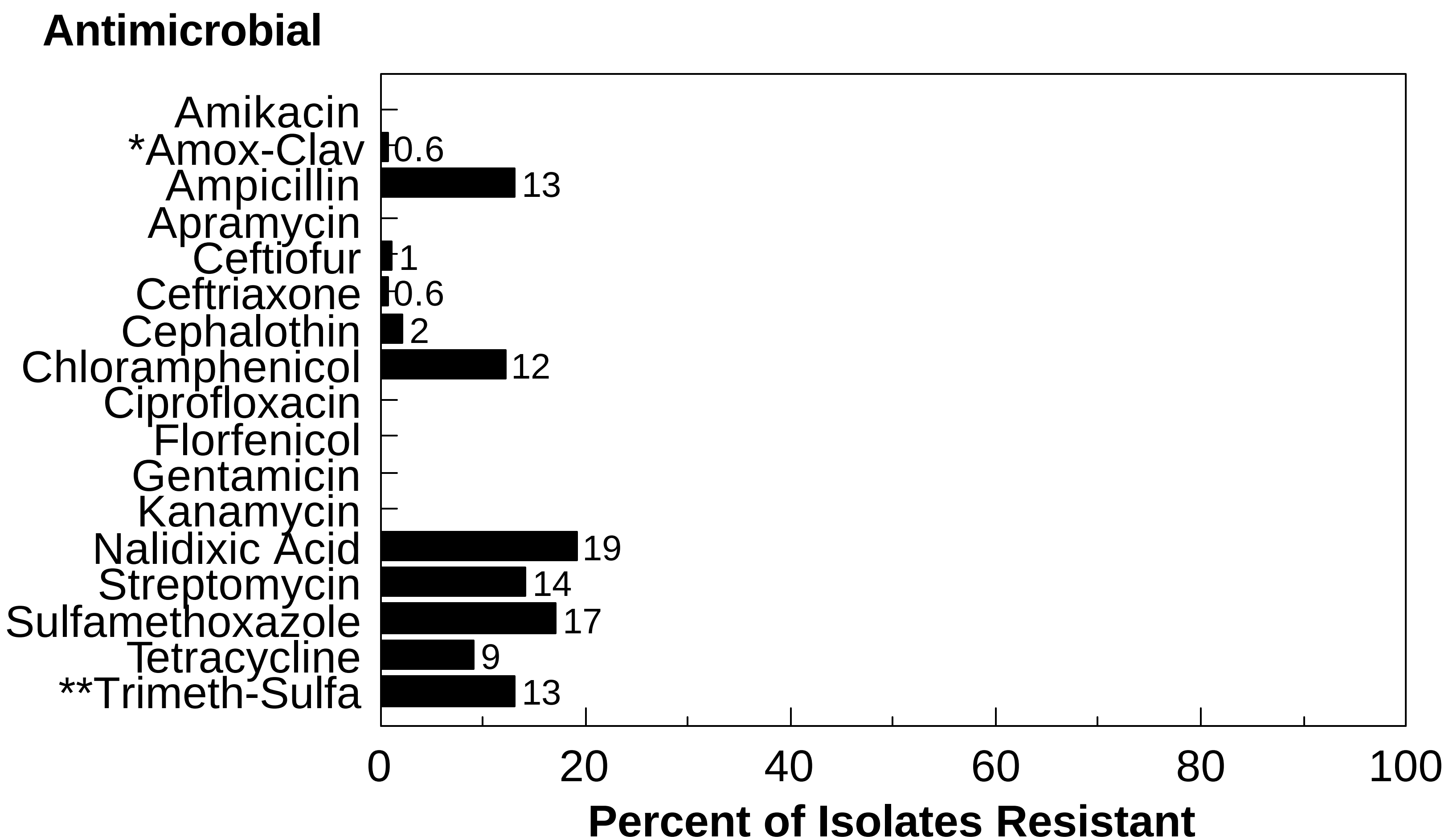
Figure 8. Resistance among *Salmonella* Typhi isolates, 1999



N=166

*Amox-Clav=Amoxicillin-Clavulanic Acid

**Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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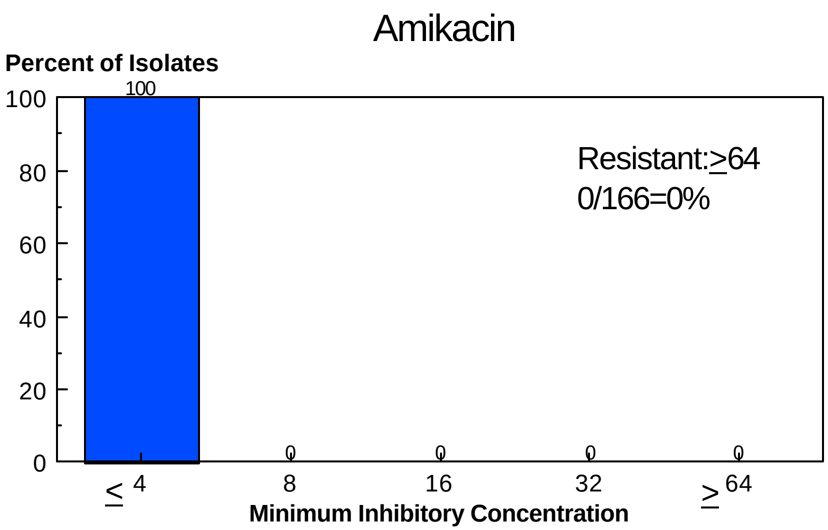
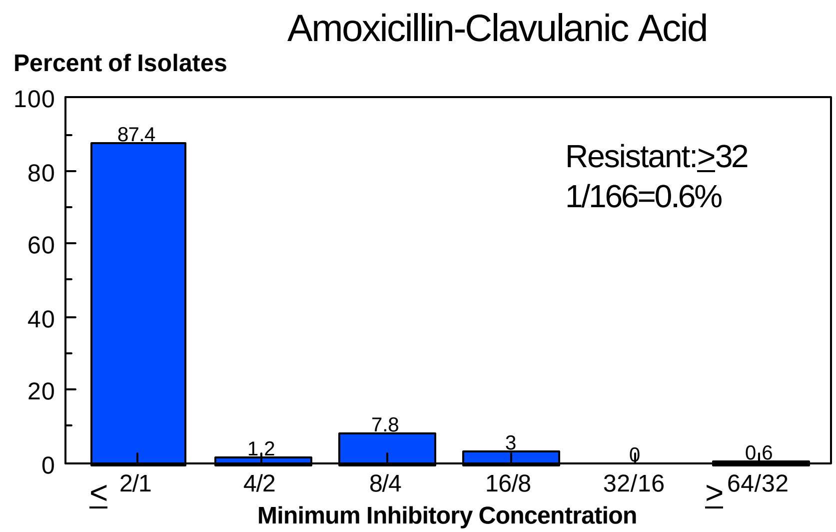
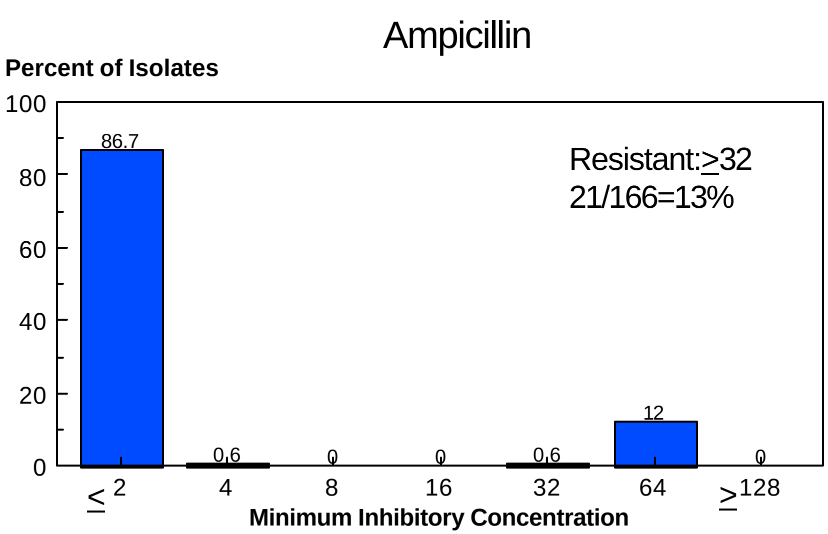
Figure 9a. MICs among *Salmonella* Typhi isolates, by antimicrobial agent, 1999







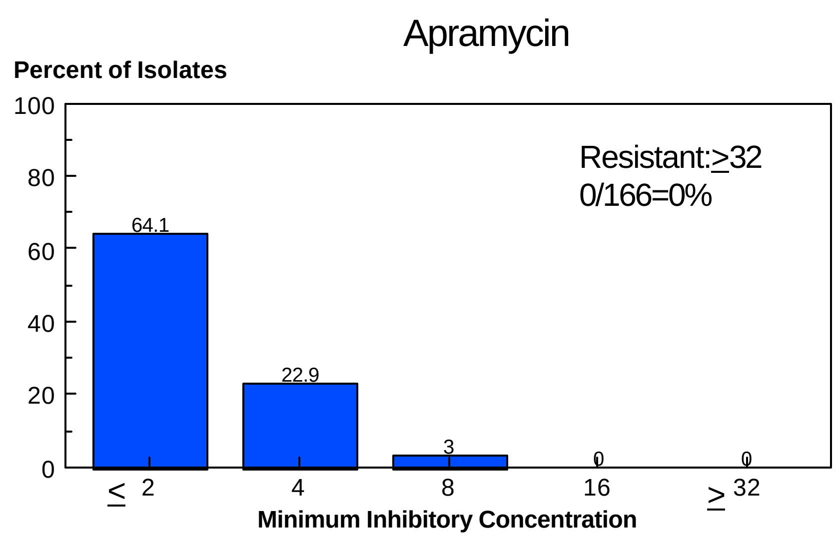


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Figure 9b. MICs among *Salmonella* Typhi isolates, by antimicrobial agent, 1999

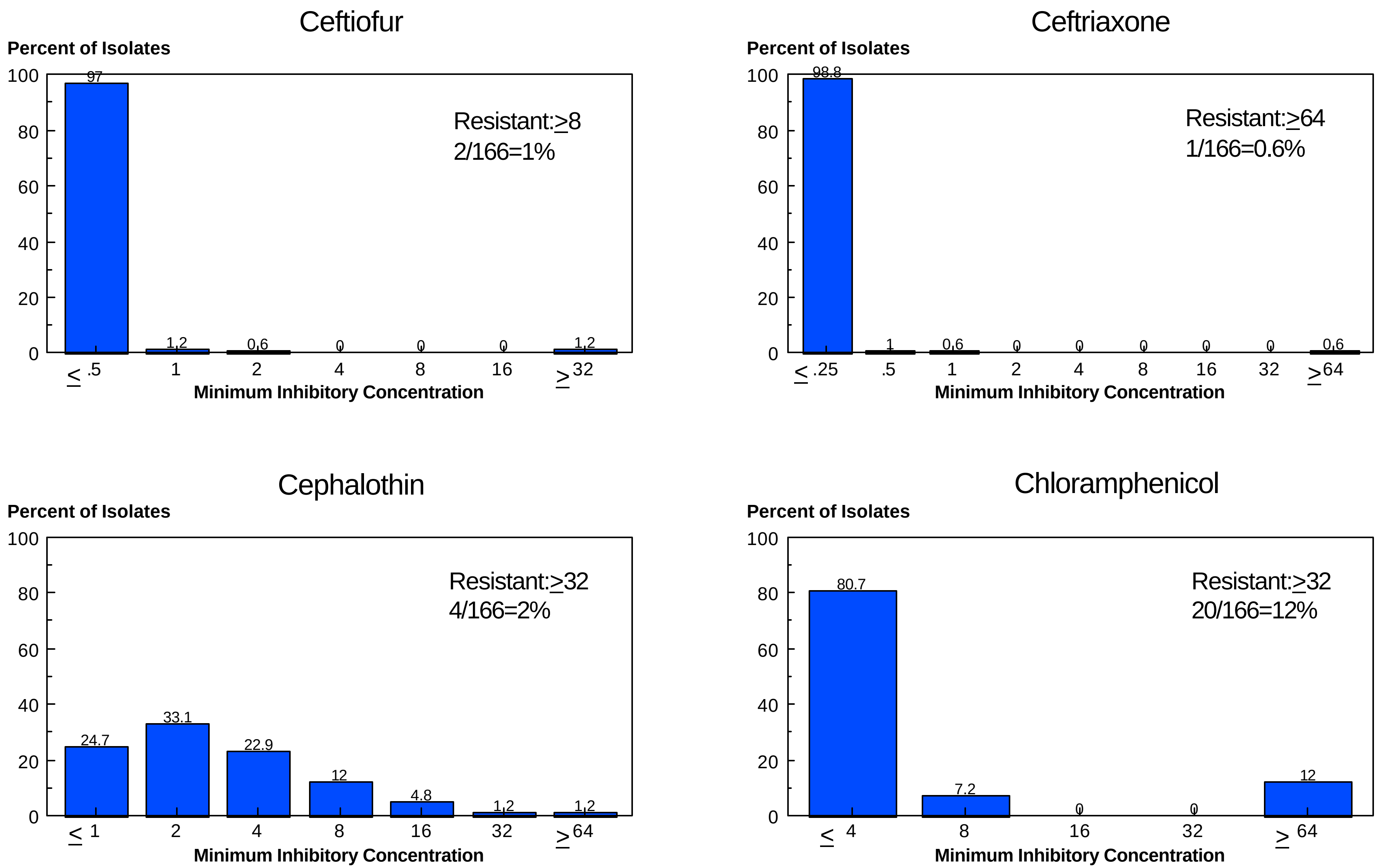

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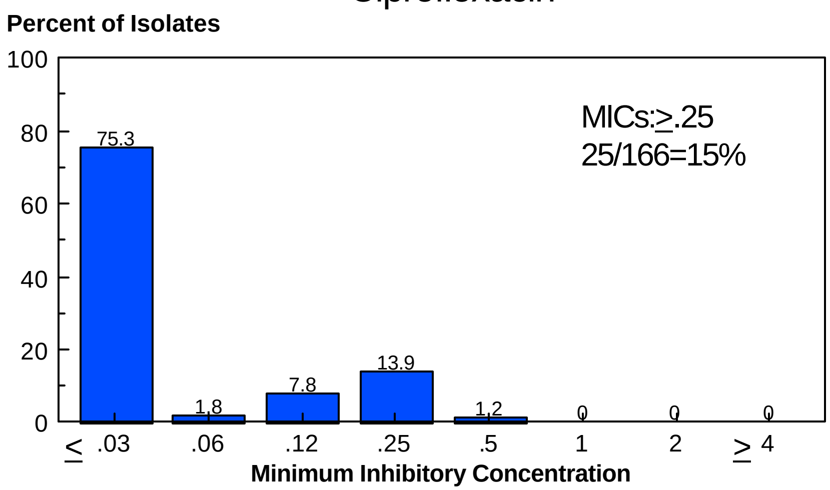
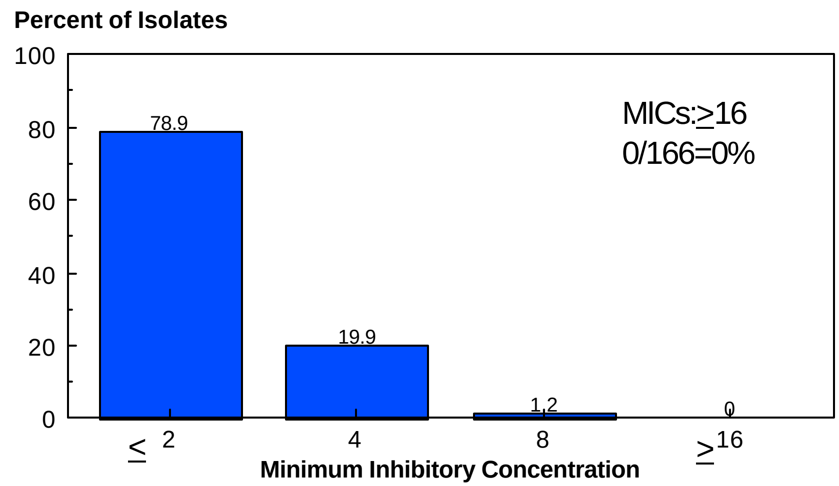
Figure 9c. MICs among *Salmonella* Typhi isolates, by antimicrobial agent, 1999

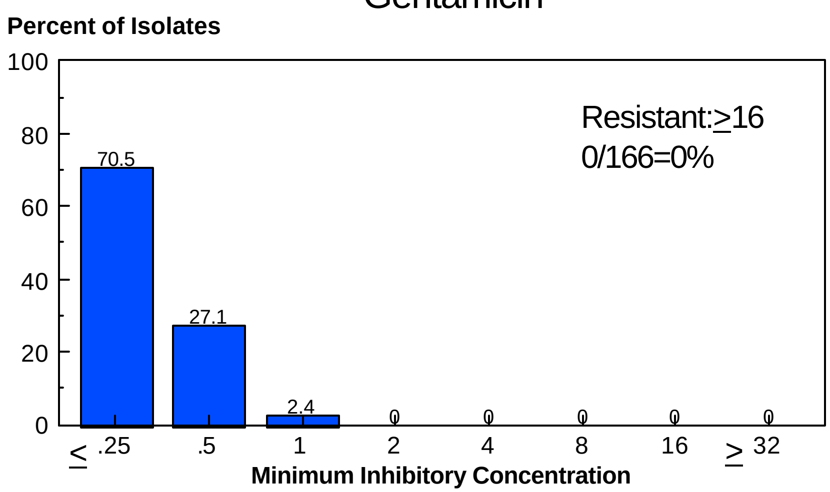
Ciprofloxacin



Florfenicol



Gentamicin



Kanamycin

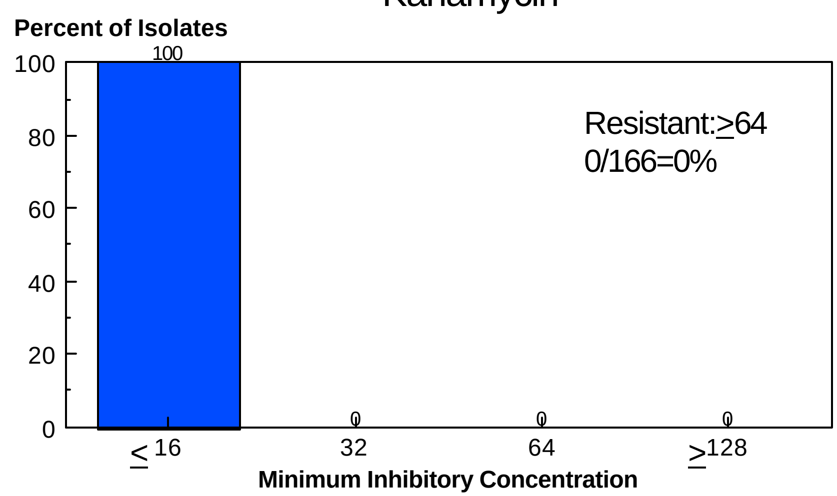


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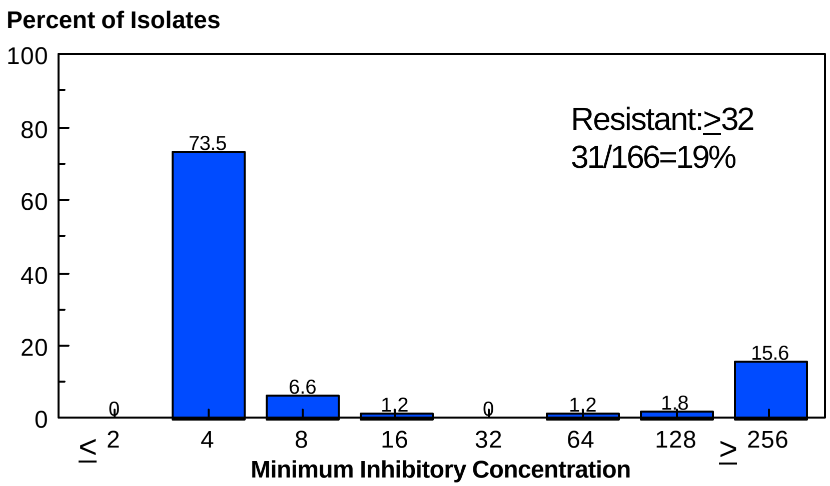
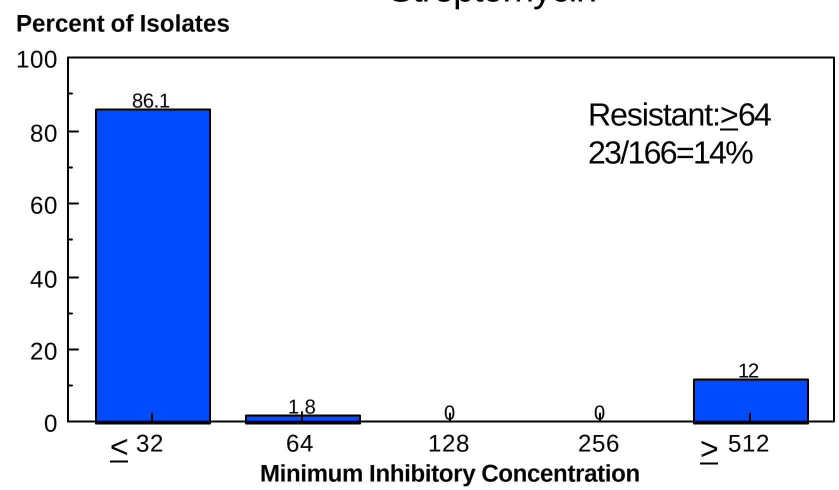
Figure 9d. MICs among *Salmonella* Typhi isolates, by antimicrobial agent, 1999

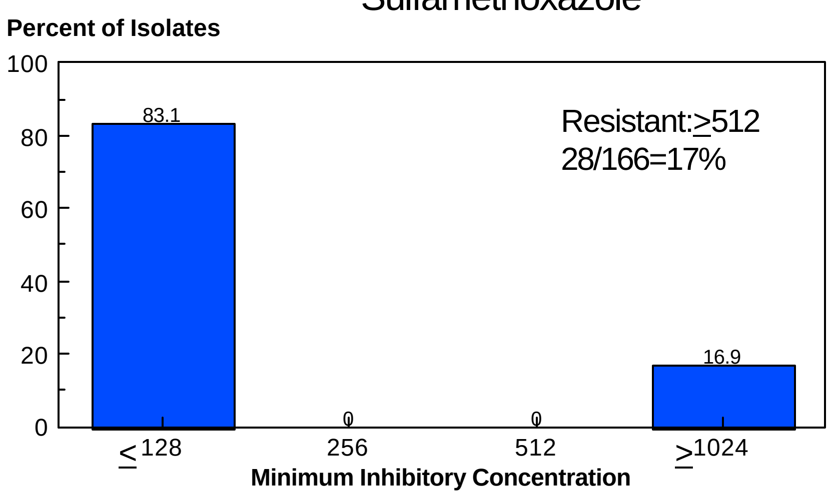
Nalidixic Acid



Streptomycin



Sulfamethoxazole



Tetracycline

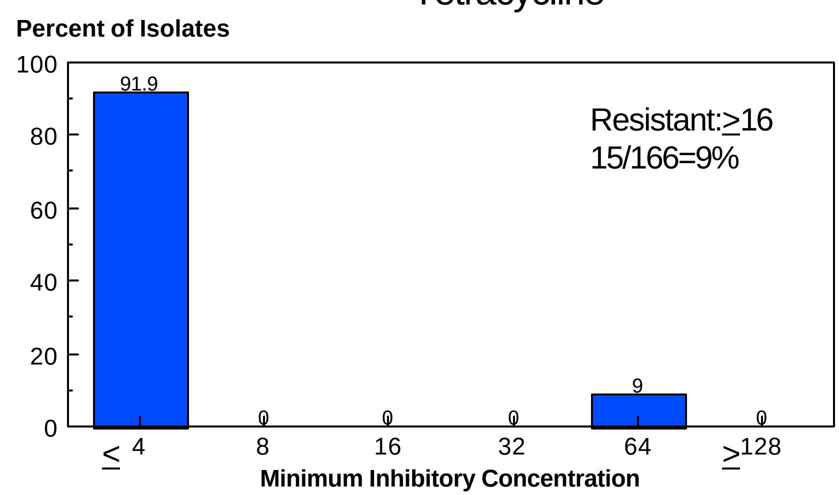


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Figure 9e. MICs among *Salmonella* Typhi isolates, by antimicrobial agent, 1999

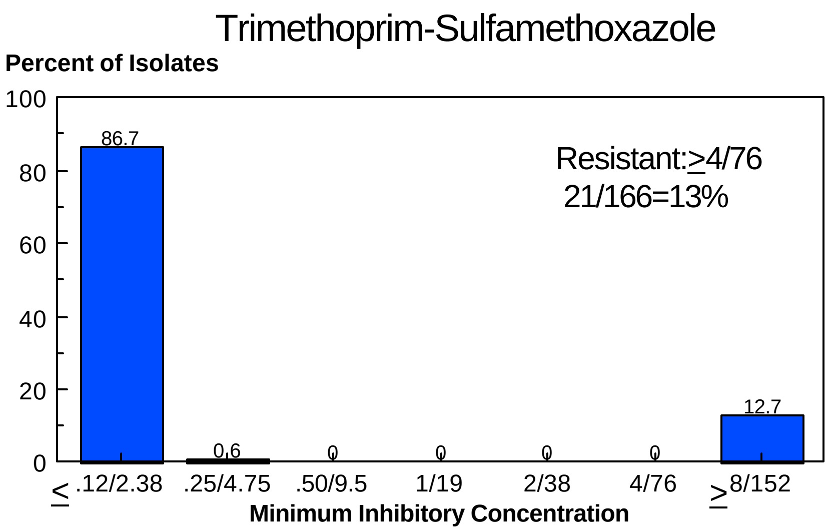

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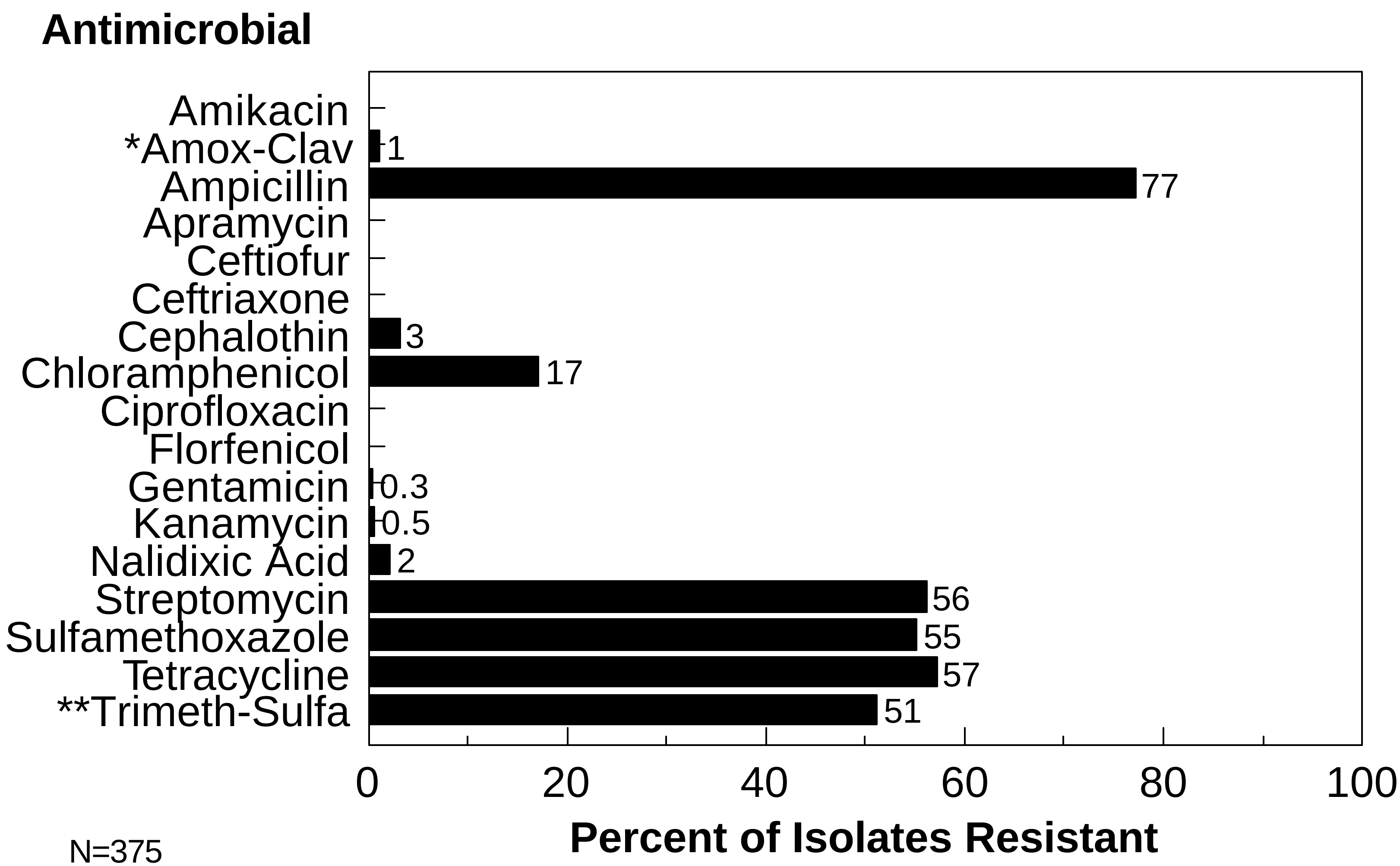
Figure 10. Resistance among *Shigella* isolates, 1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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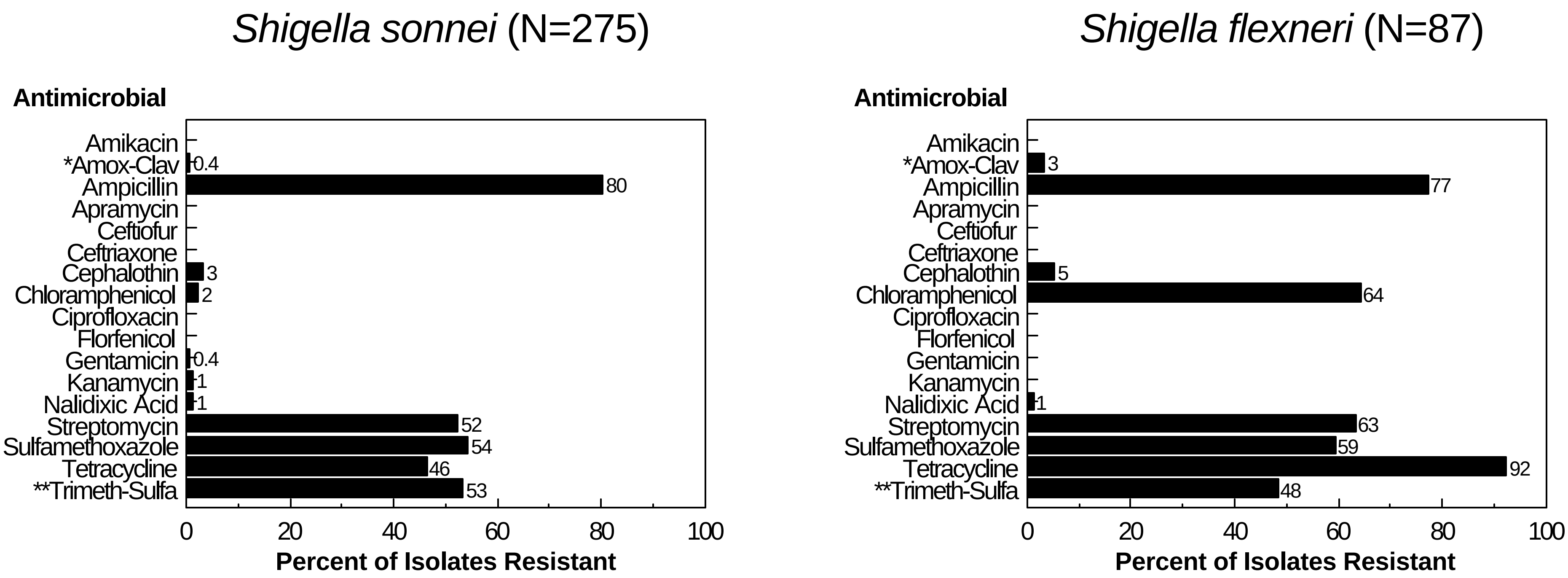
Figure 11. Resistance among *Shigella sonnei* and *Shigella flexneri* isolates, 1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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Figure 12a. MICs among *Shigella sonnei* isolates, by antimicrobial agent, 1999

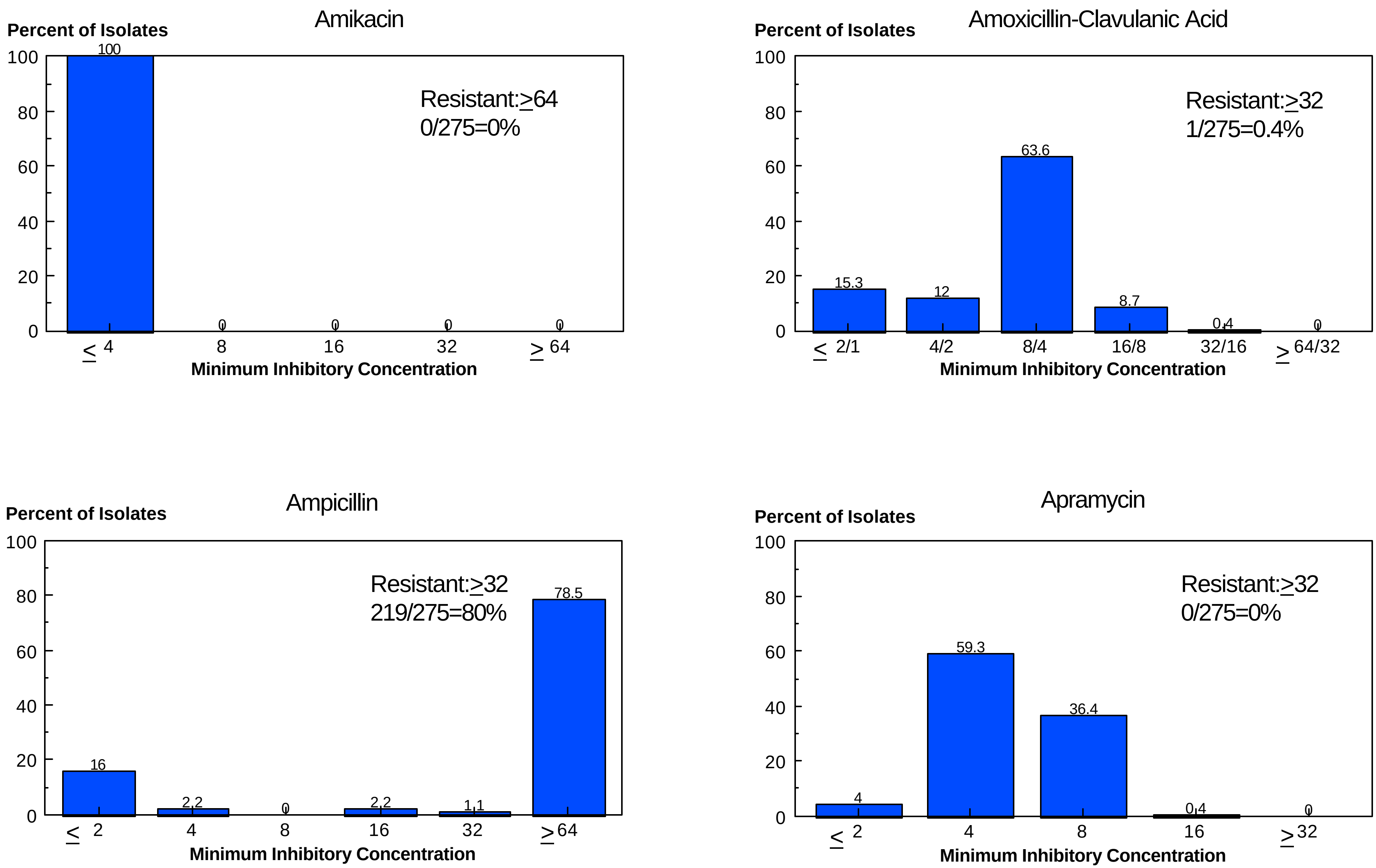

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Figure 12b. MICs among *Shigella sonnei* isolates, by antimicrobial agent, 1999

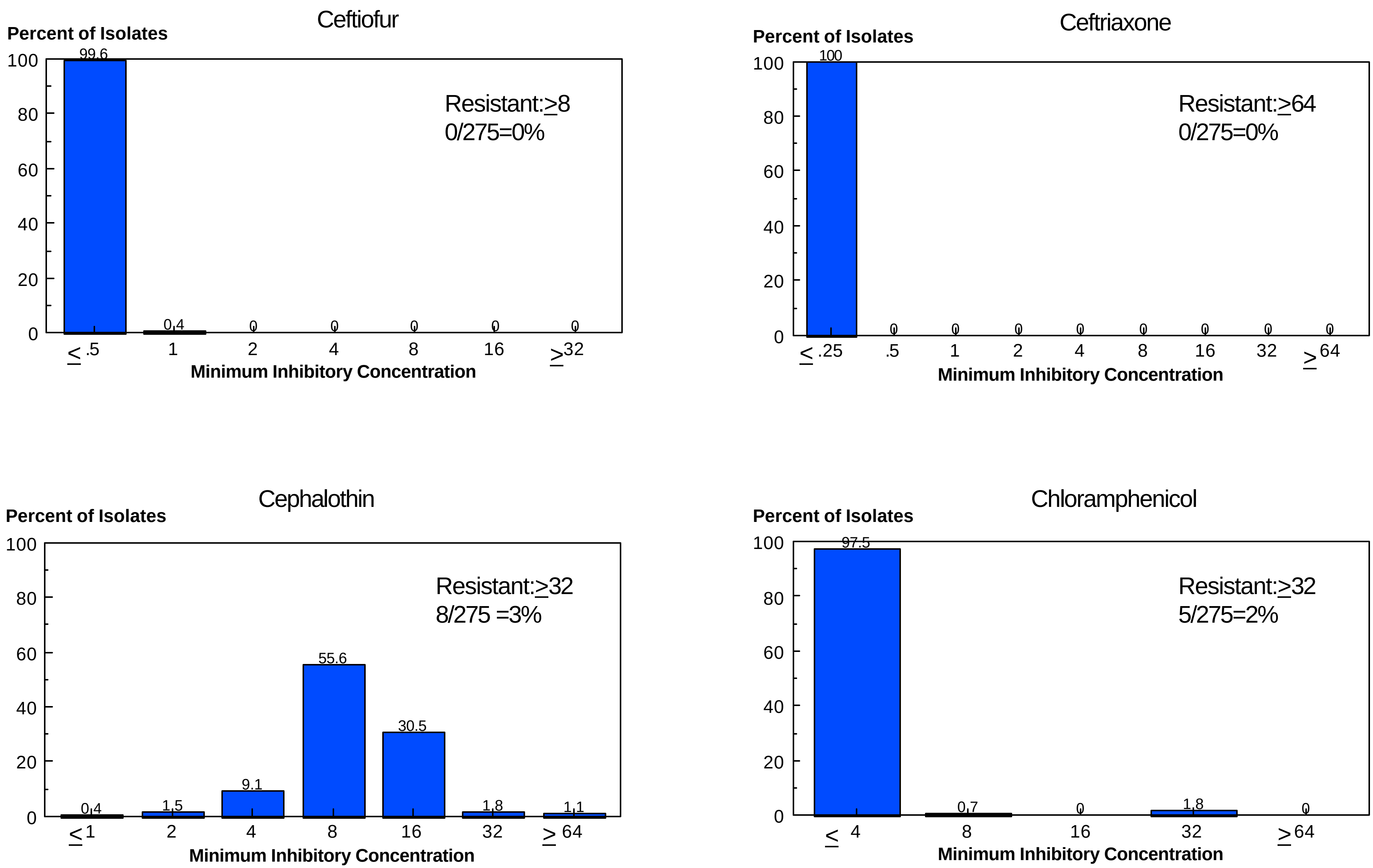

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Figure 12c. MICs among *Shigella sonnei* isolates, by antimicrobial agent, 1999

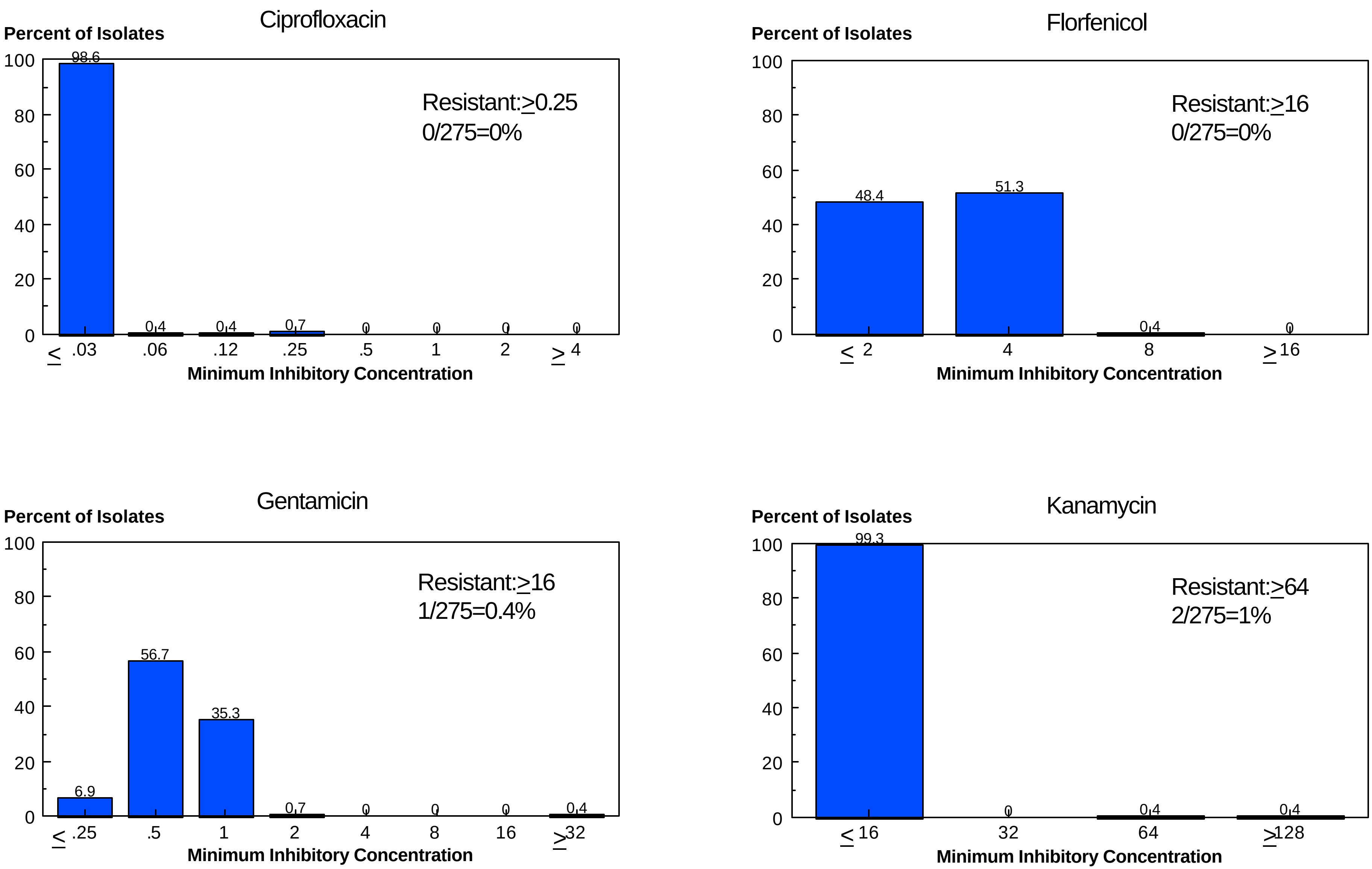

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Figure 12d. MICs among *Shigella sonnei* isolates, by antimicrobial agent, 1999

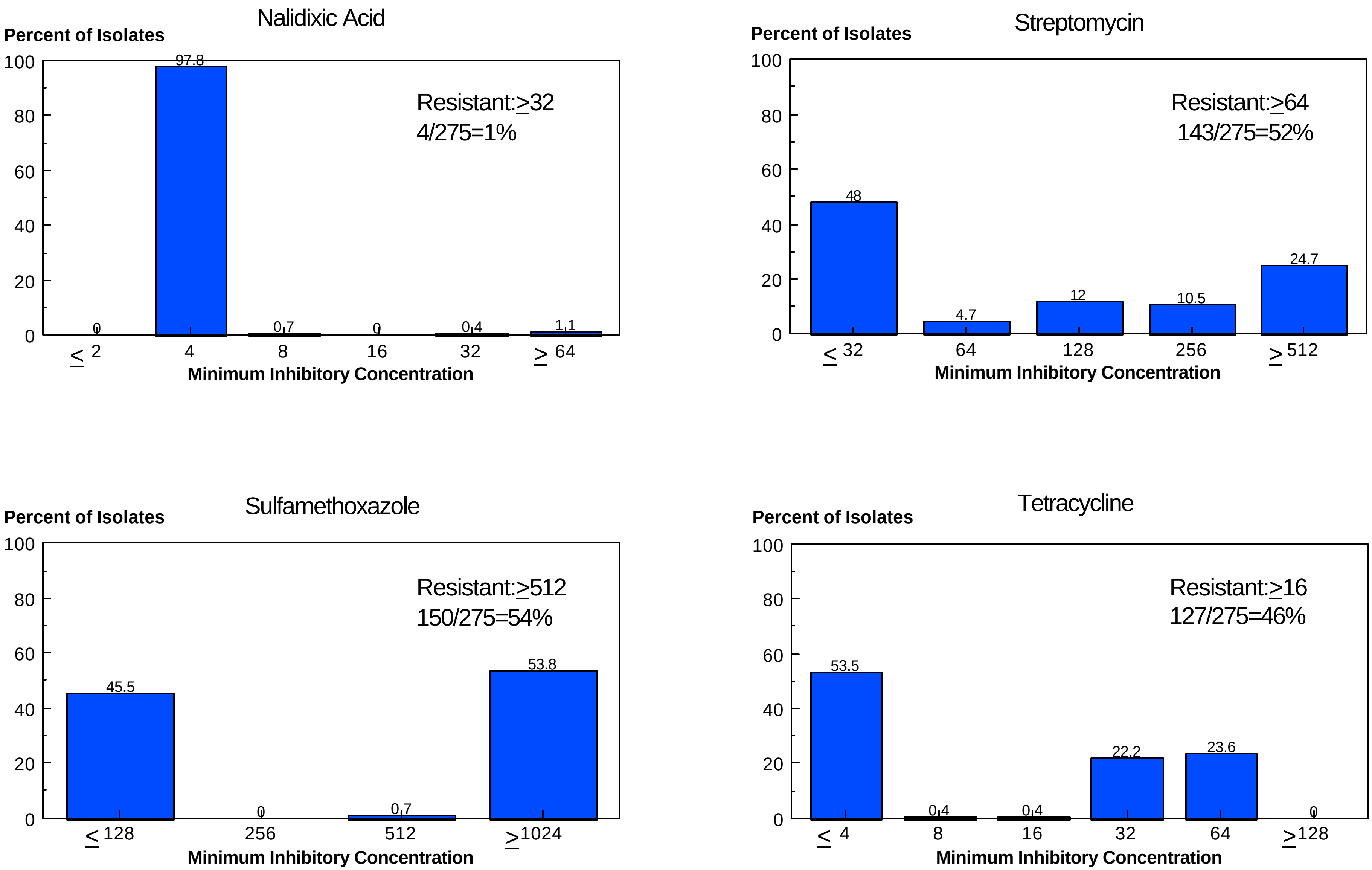

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Figure 12e. MICs among *Shigella sonnei* isolates, by antimicrobial agent, 1999

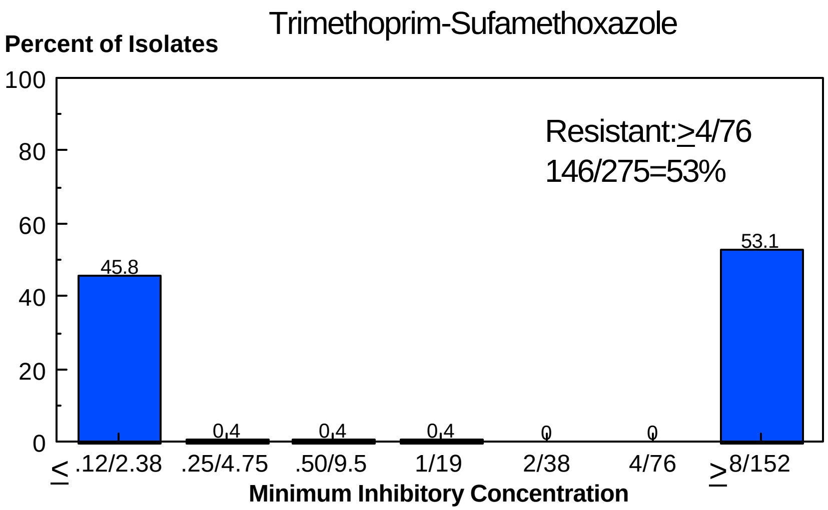

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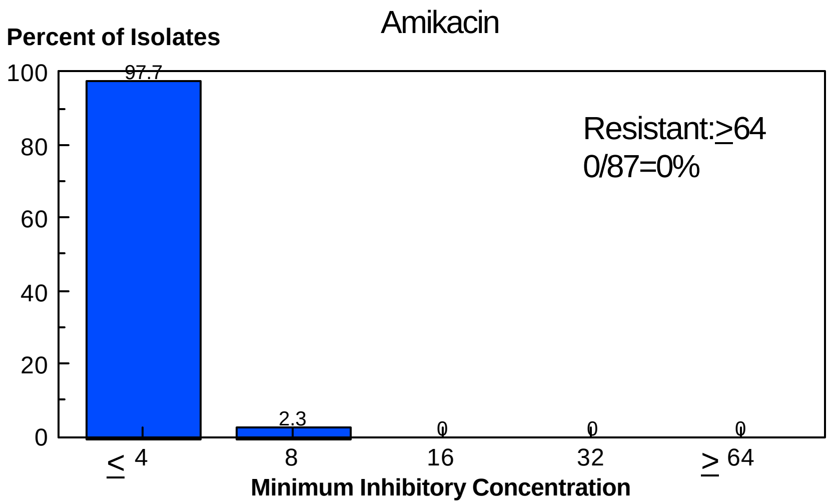
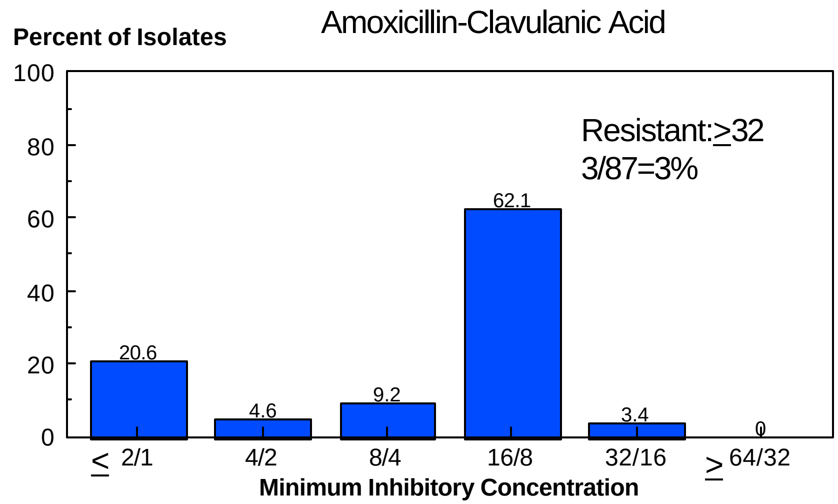
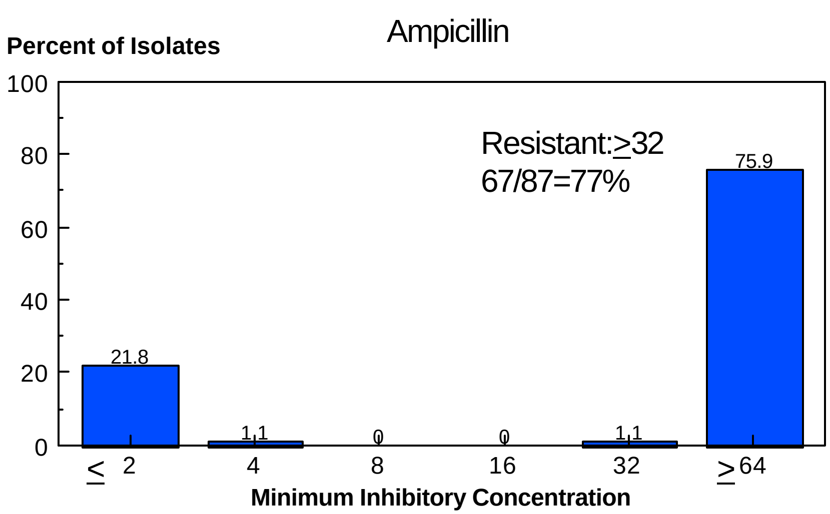
Figure 13a. MICs among *Shigella flexneri* isolates, by antimicrobial agent, 1999







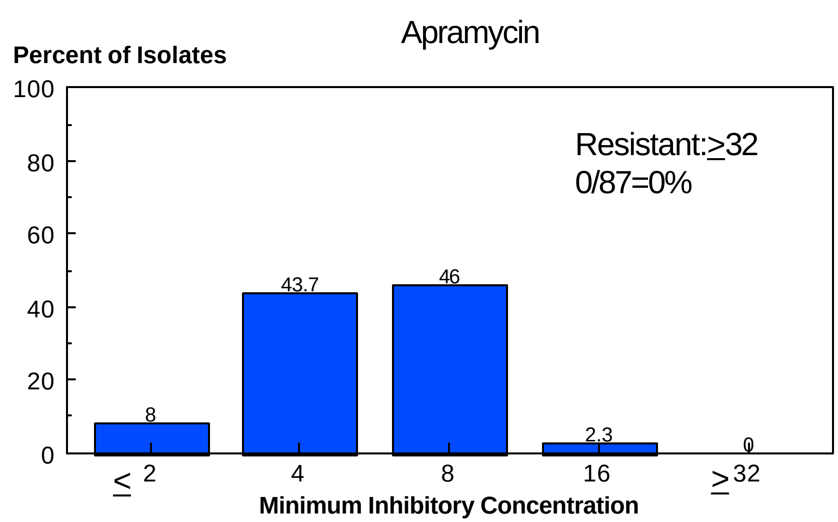


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Figure 13b. MICs among *Shigella flexneri* isolates, by antimicrobial agent, 1999

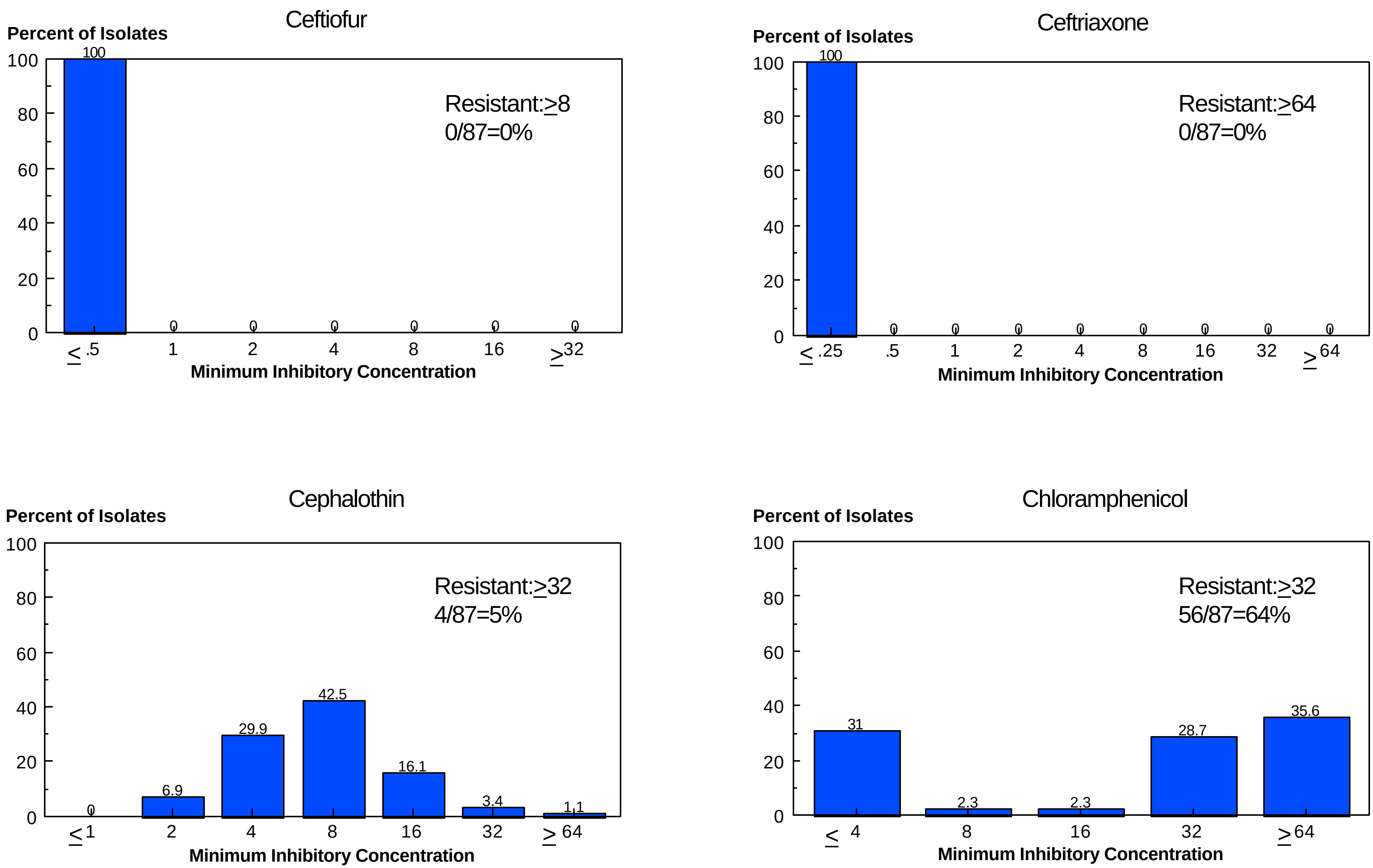

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Figure 13c. MICs among *Shigella flexneri* isolates, by antimicrobial agent, 1999

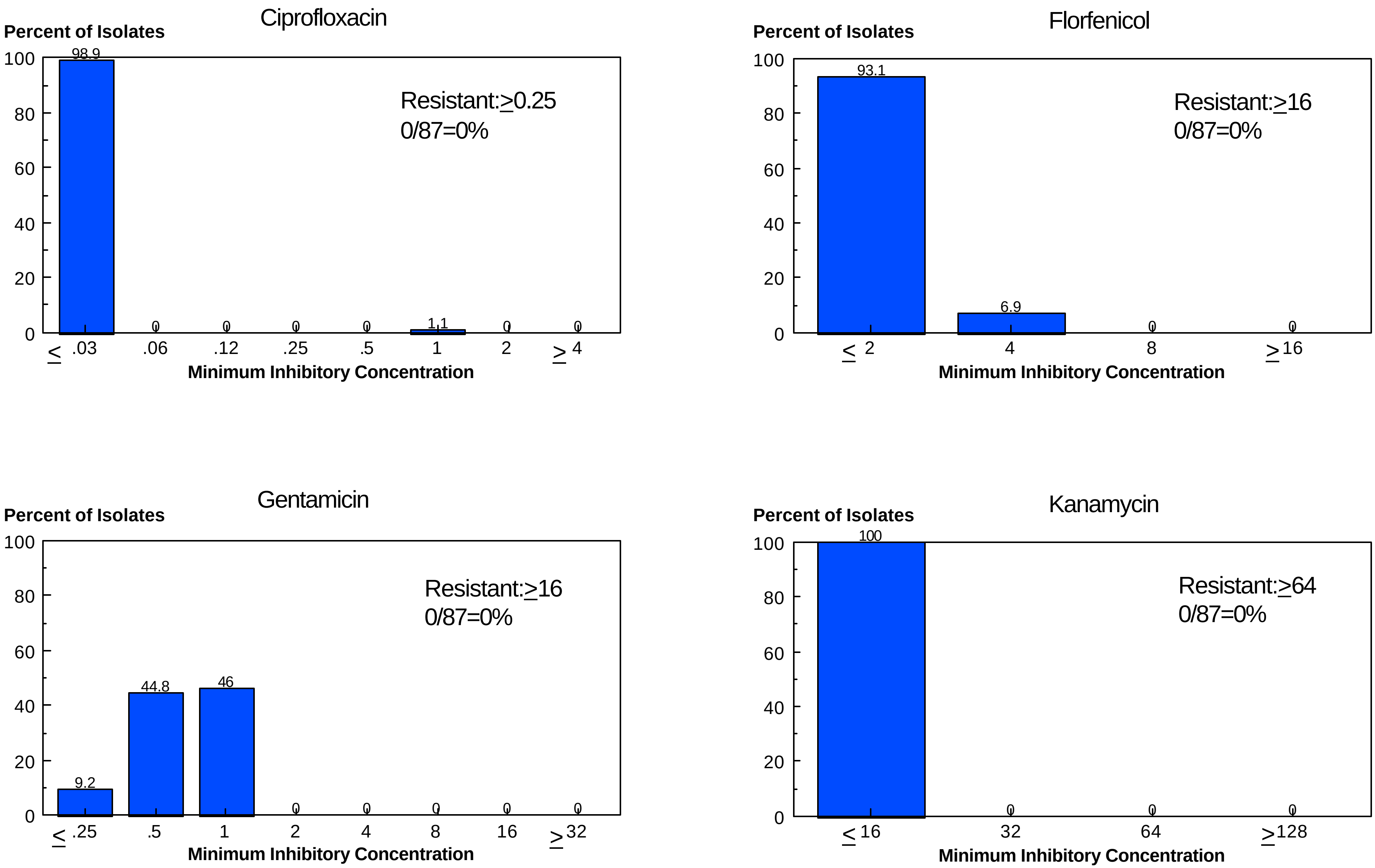

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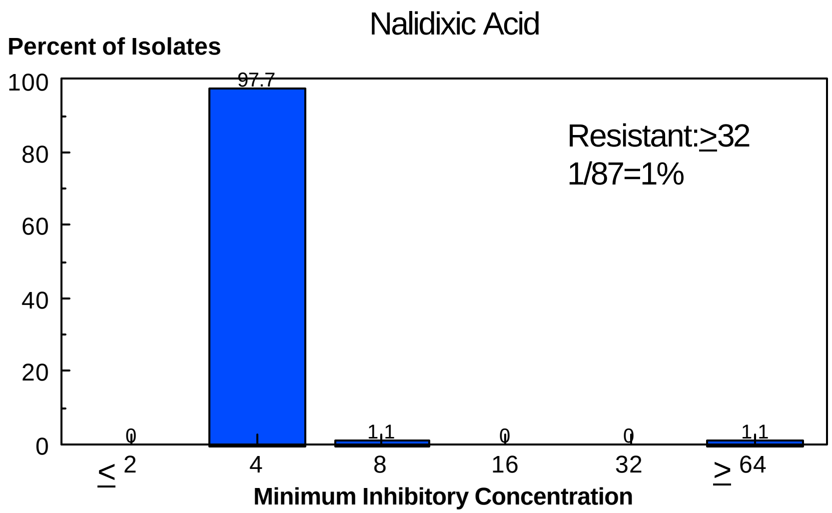
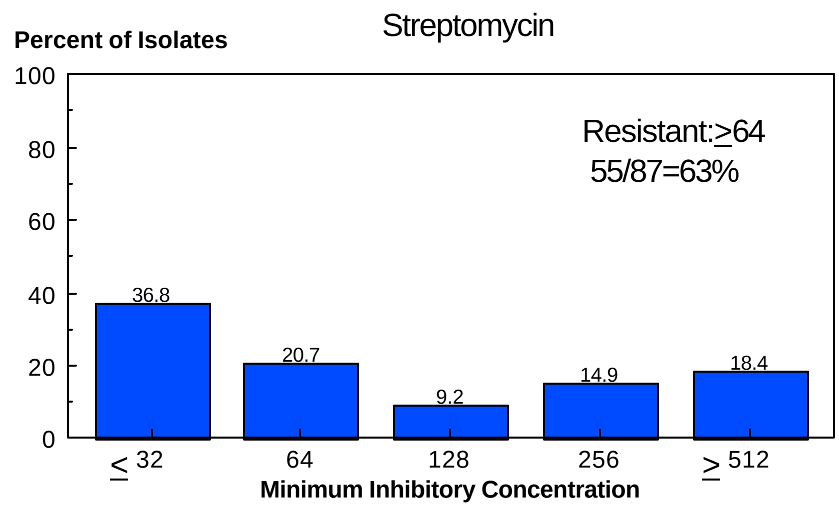
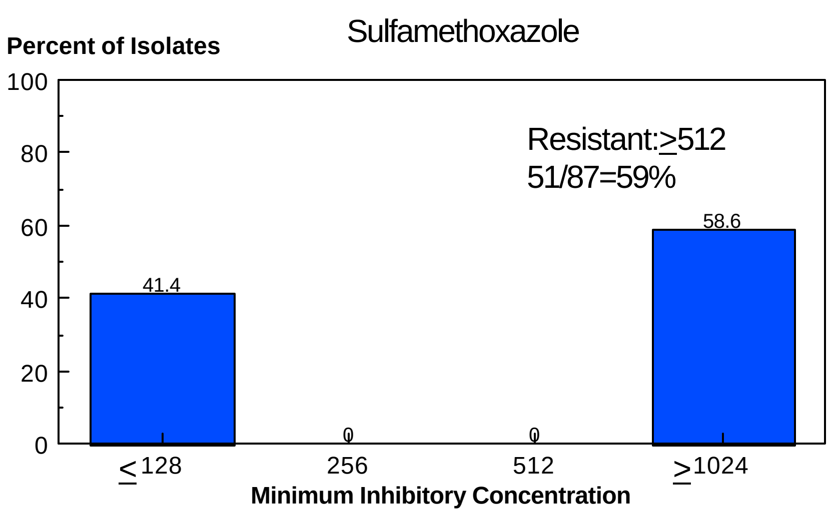
Figure 13d. MICs among *Shigella flexneri* isolates, by antimicrobial agent, 1999







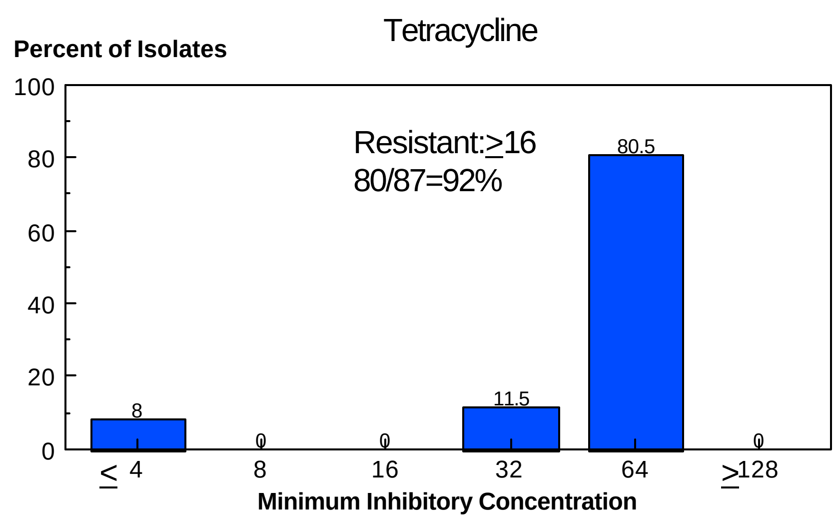


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Figure 13e. MICs among *Shigella flexneri* isolates, by antimicrobial agent, 1999

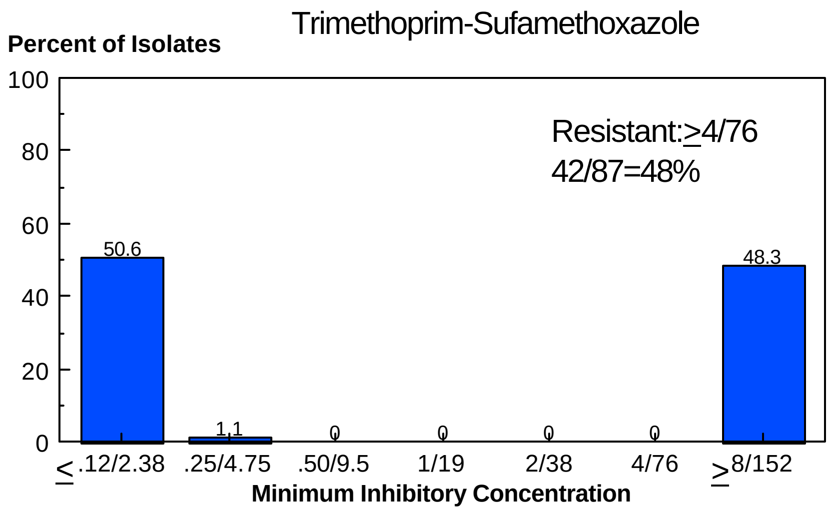

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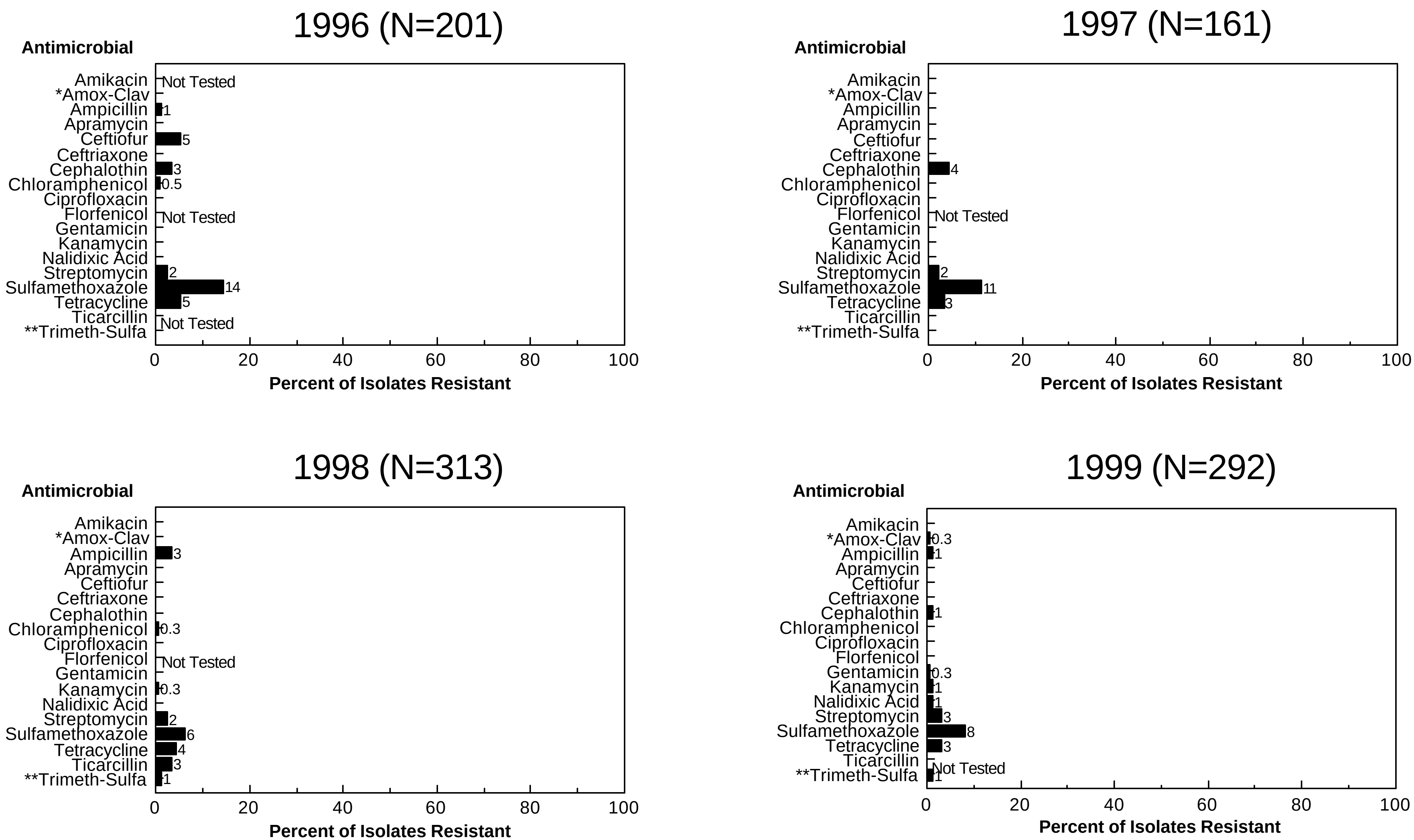
Figure 14. Resistance among *E. coli* O157 isolates, 1996-1999



*Amox-Clav=Amoxicillin-Clavulanic Acid **Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

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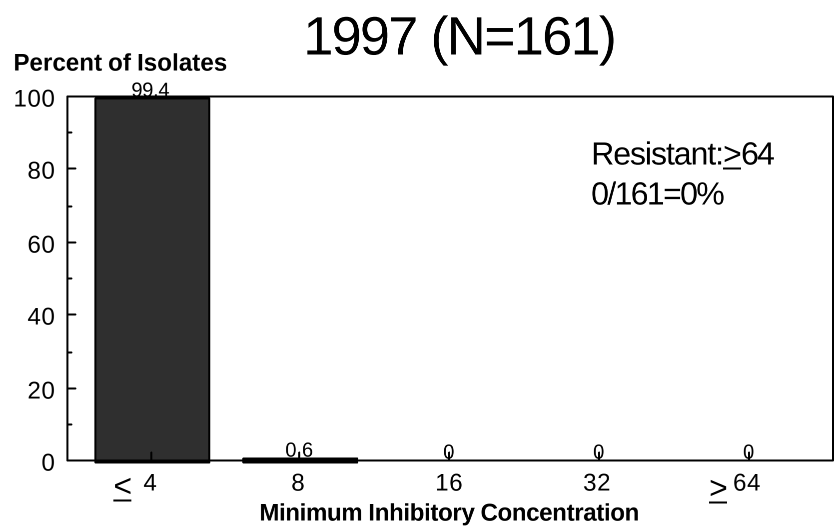
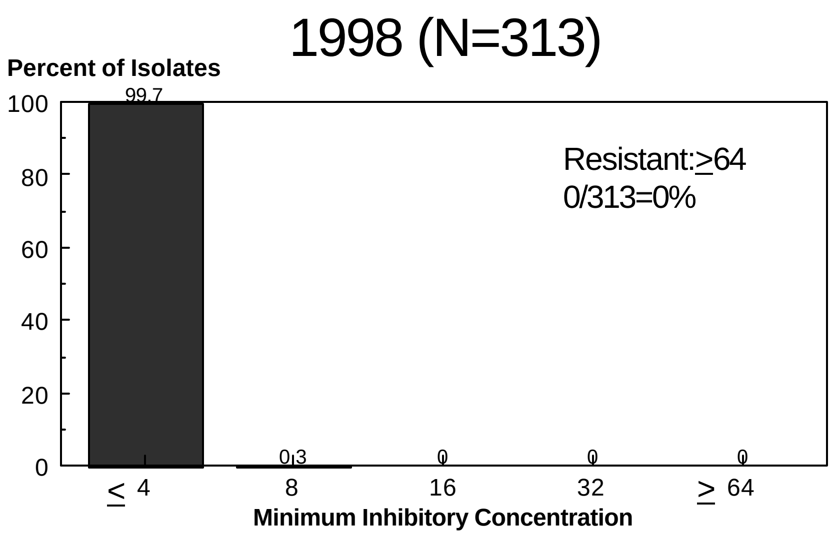
Figure 15a. MICs for Amikacin among *E. coli* O157 isolates, 1996 - 1999

Not tested in 1996





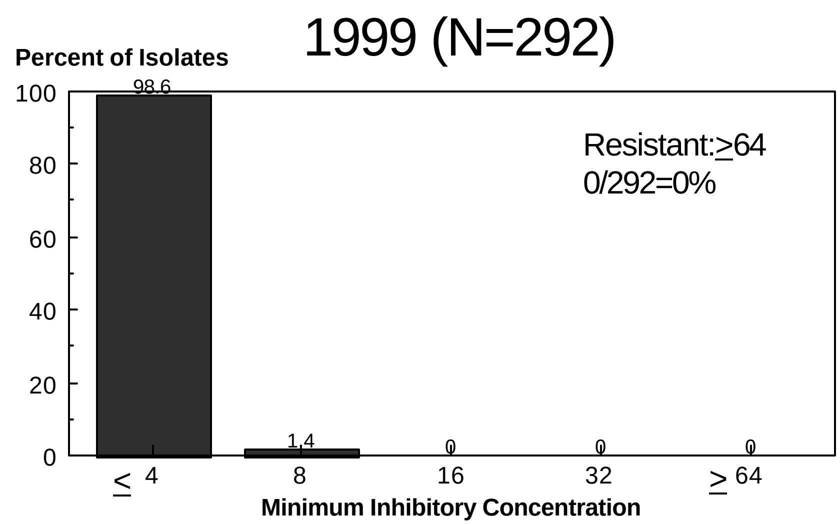


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Figure 15b. MICs for Amoxicillin-Clavulanic Acid among *E. coli* O157 isolates, 1996 - 1999

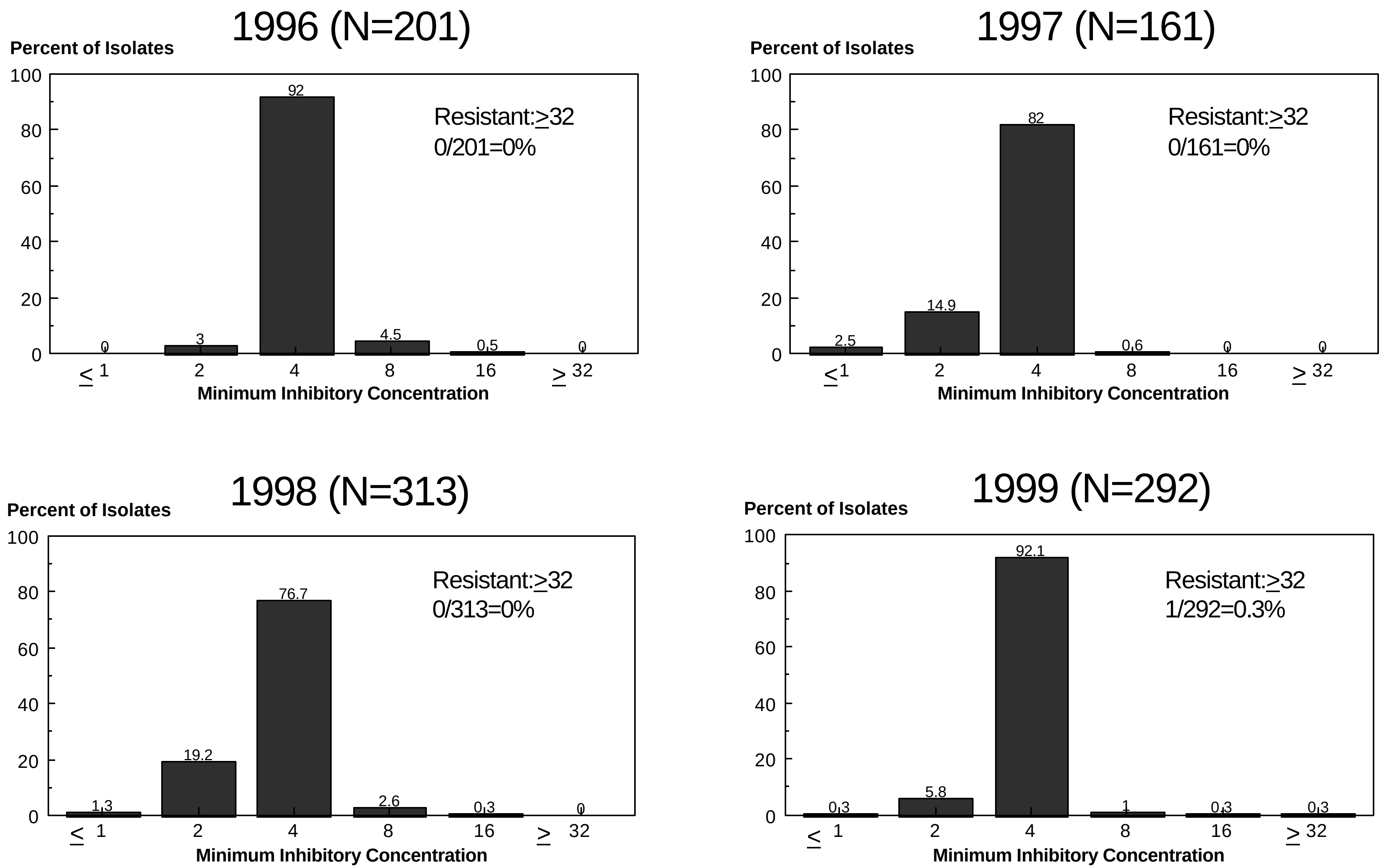

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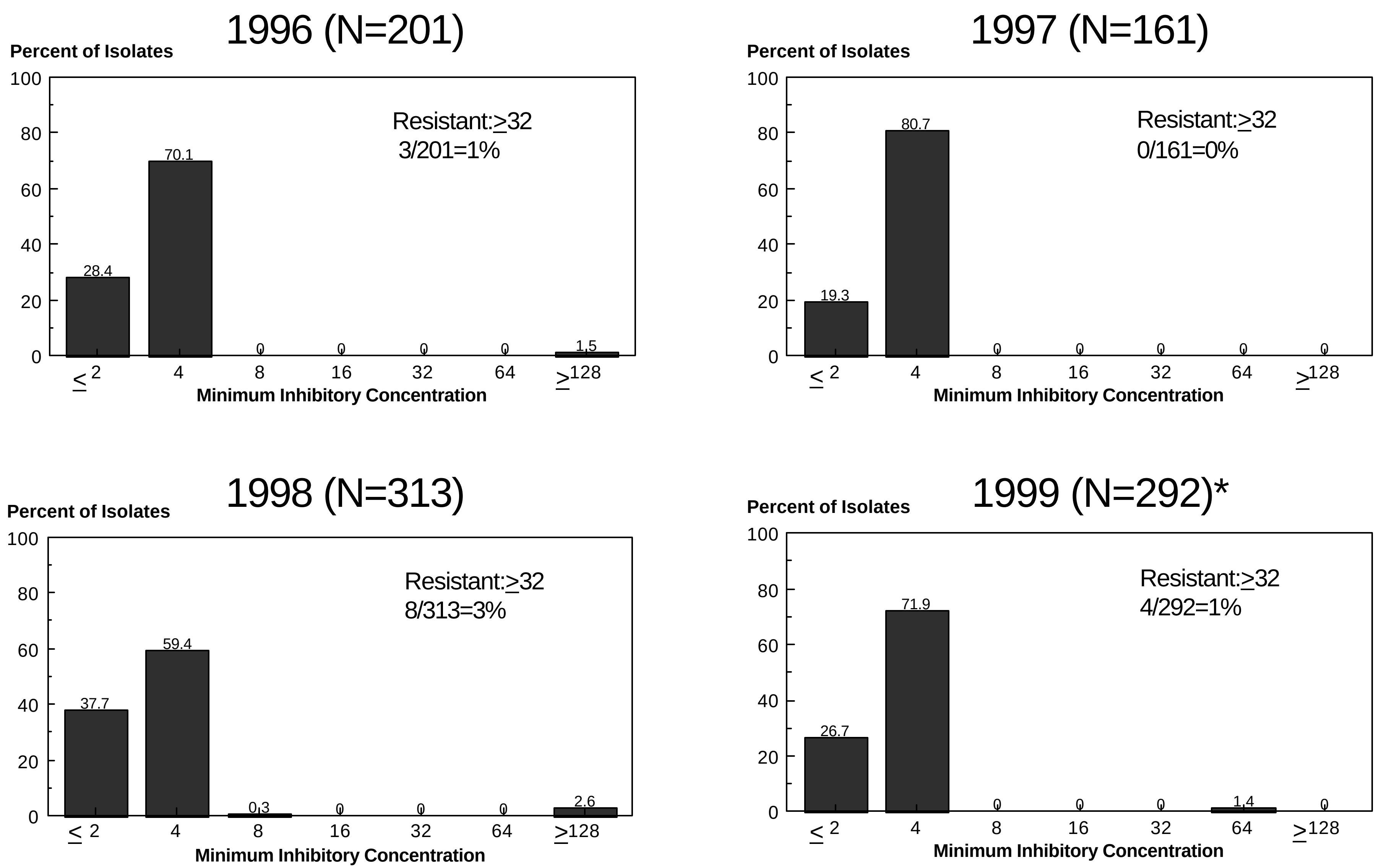
Figure 15c. MICs for Ampicillin among *E. coli* O157 isolates, 1996 - 1999



* Maximum MIC dilution for 1999 was 32 ug/ml. All resistant isolates had a MIC >32 ug/ml.

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Figure 15d. MICs for Apramycin among *E. coli* O157 isolates, 1996 - 1999

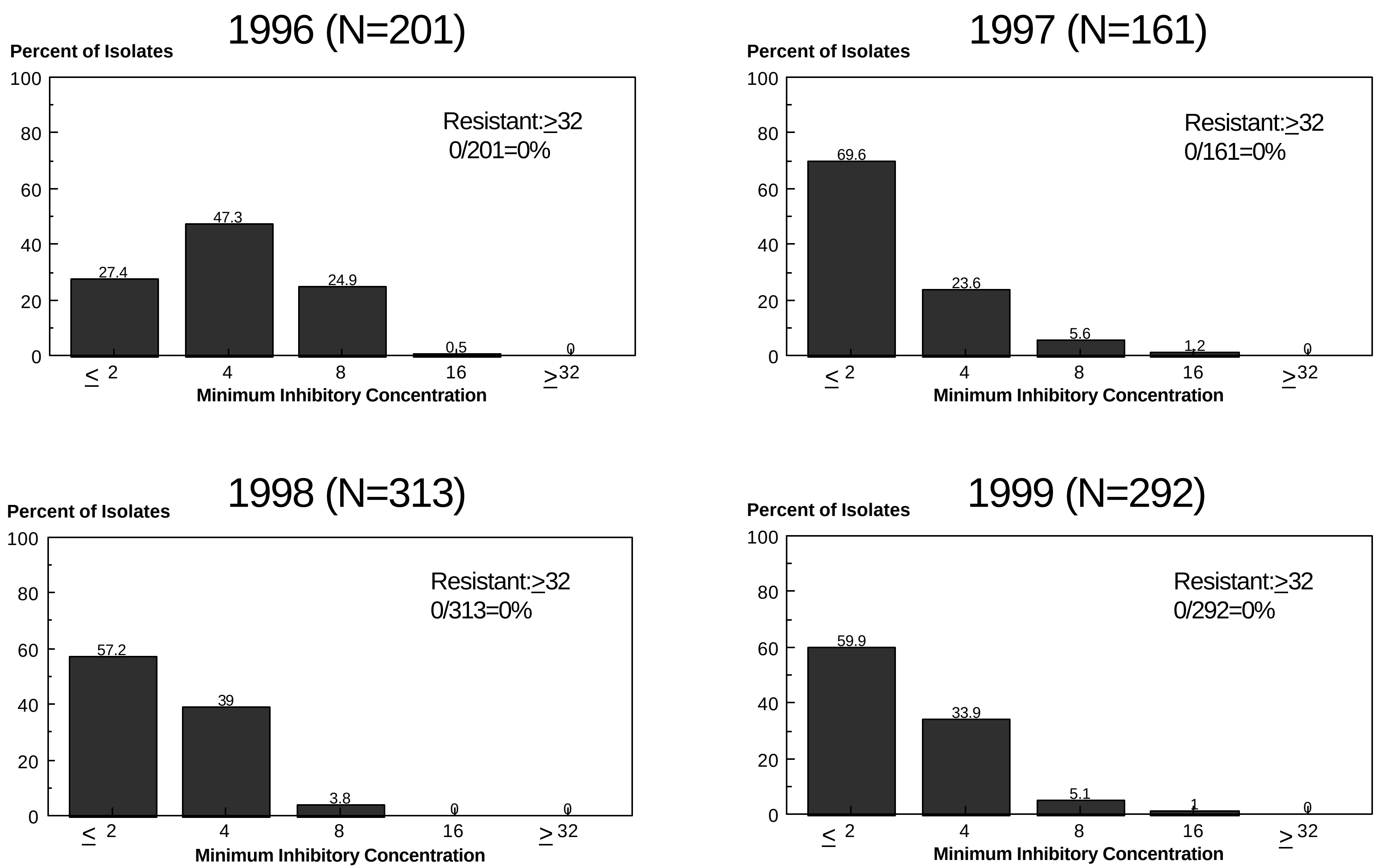

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Figure 15e. MICs for Ceftiofur among *E. coli* O157 isolates, 1996 - 1999

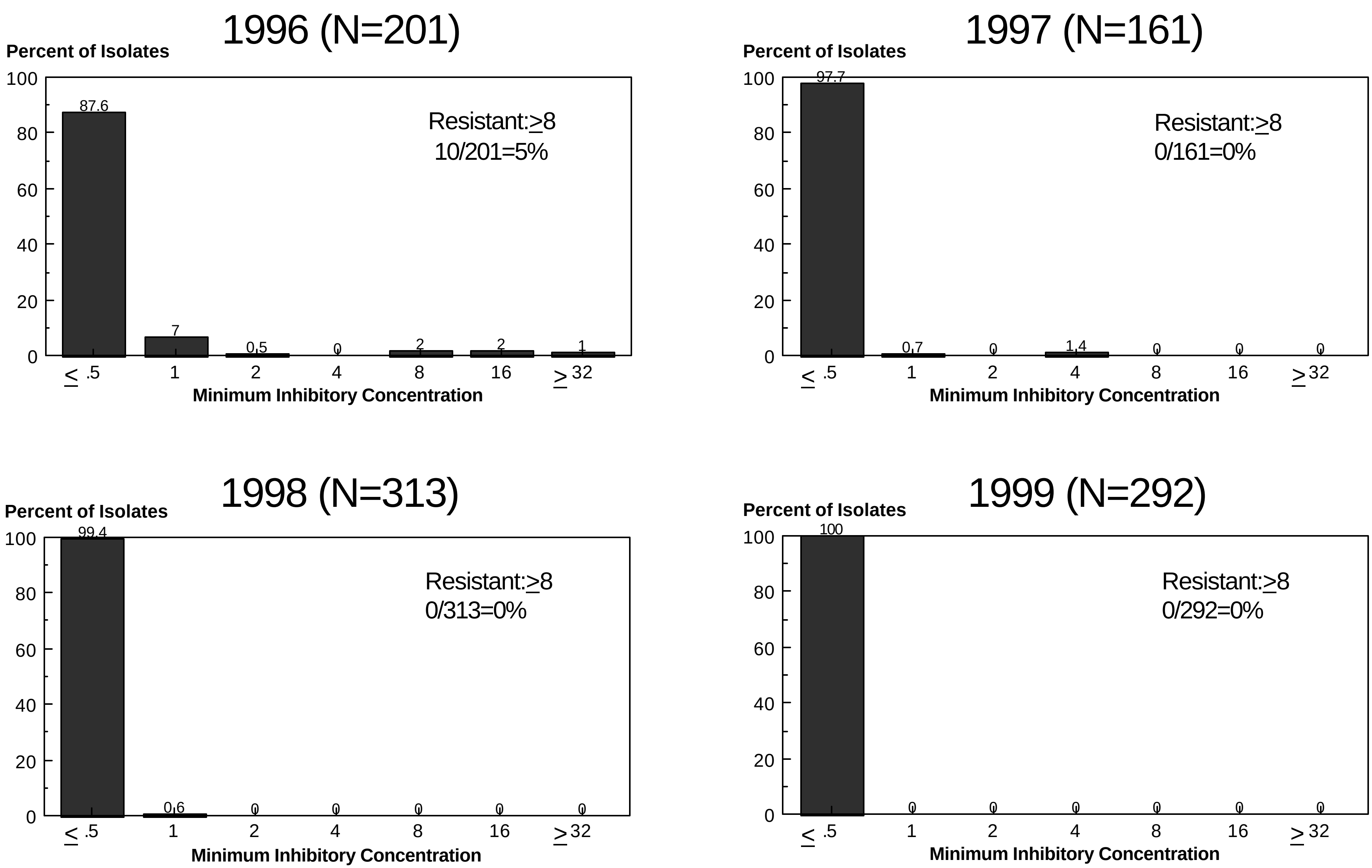

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Figure 15f. MICs for Ceftriaxone among *E. coli* O157 isolates, 1996 - 1999

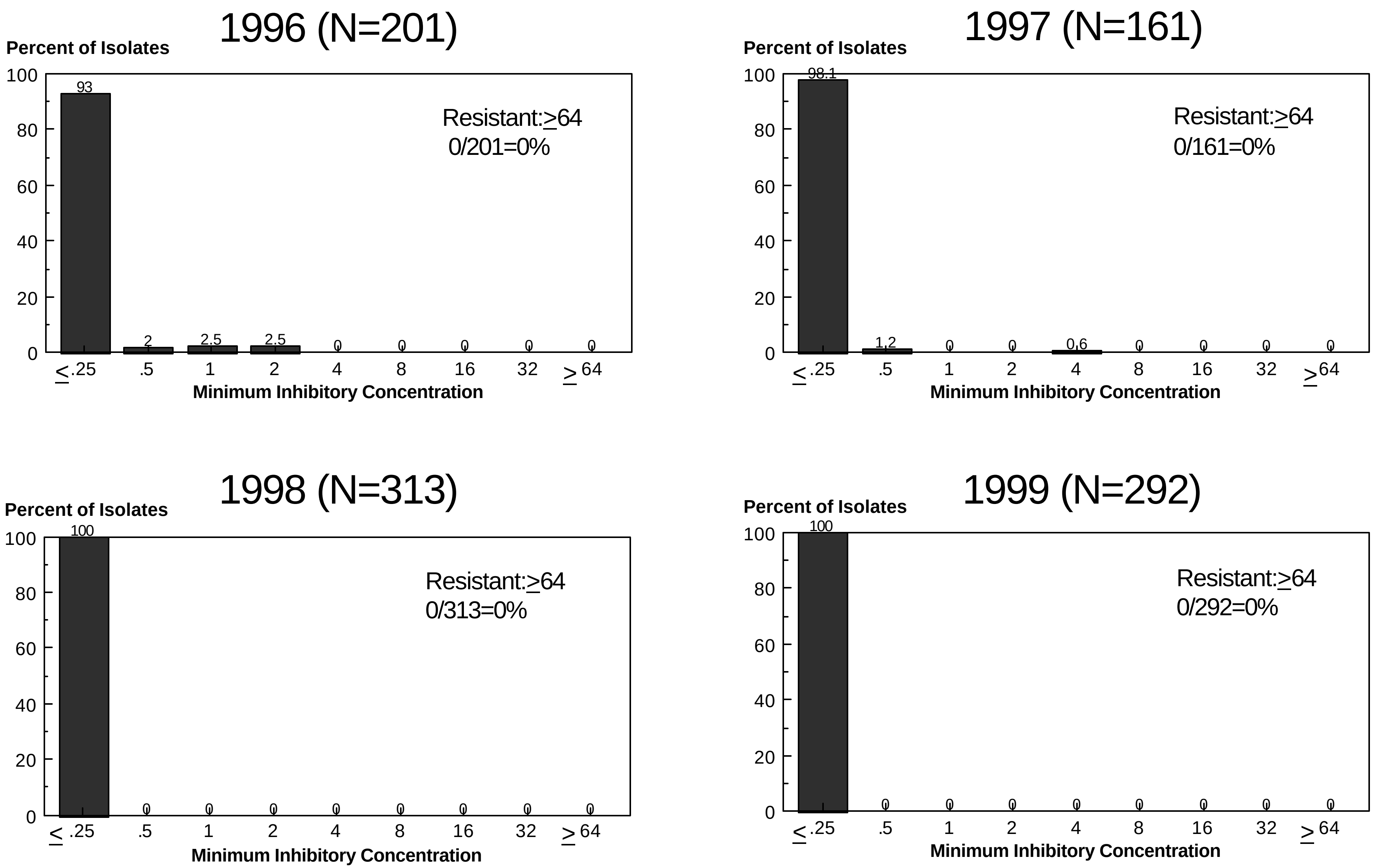

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Figure 15g. MICs for Cephalothin among *E. coli* O157 isolates, 1996 - 1999

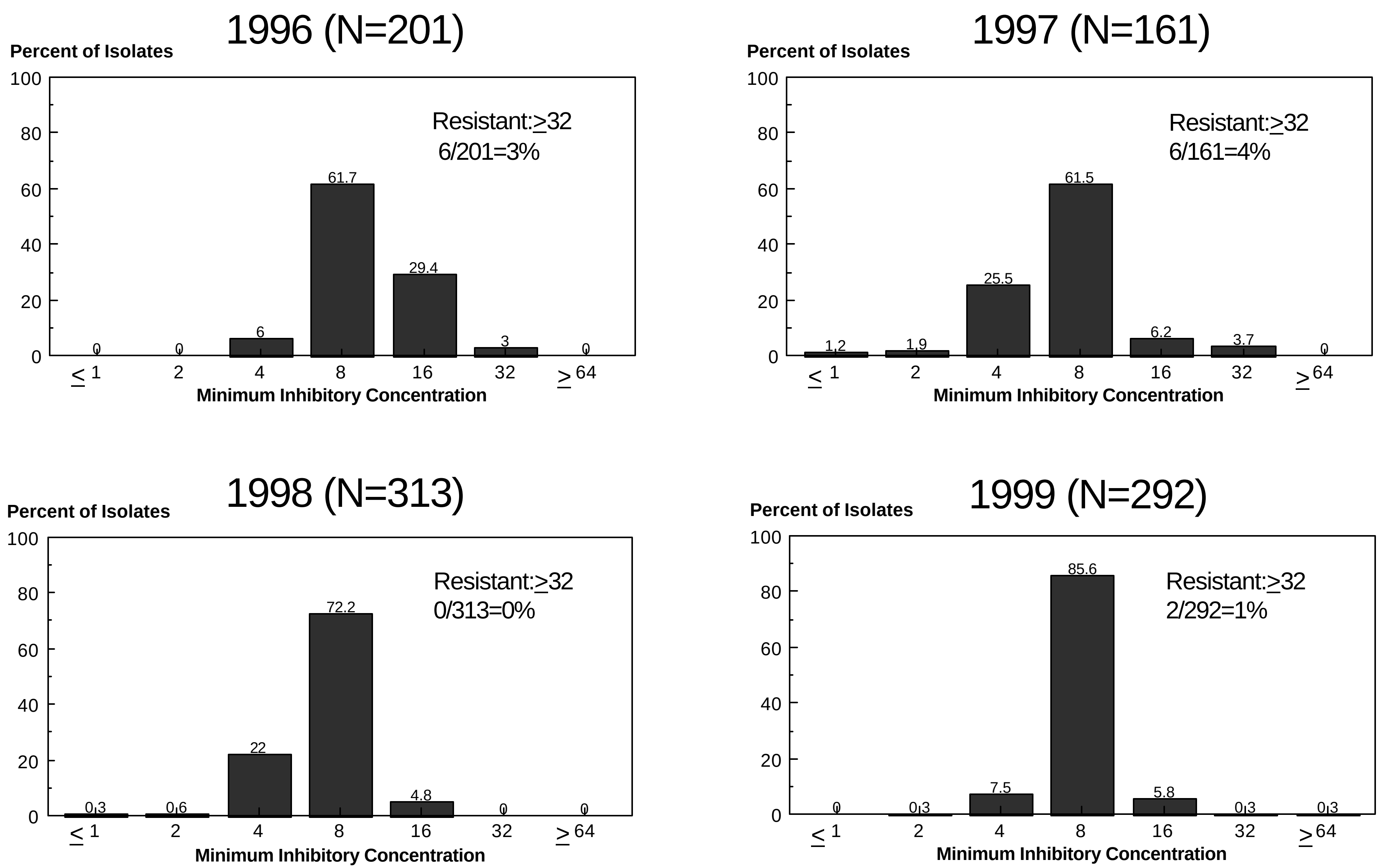

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Figure 15h. MICs for Chloramphenicol among *E. coli* O157 isolates, 1996 - 1999

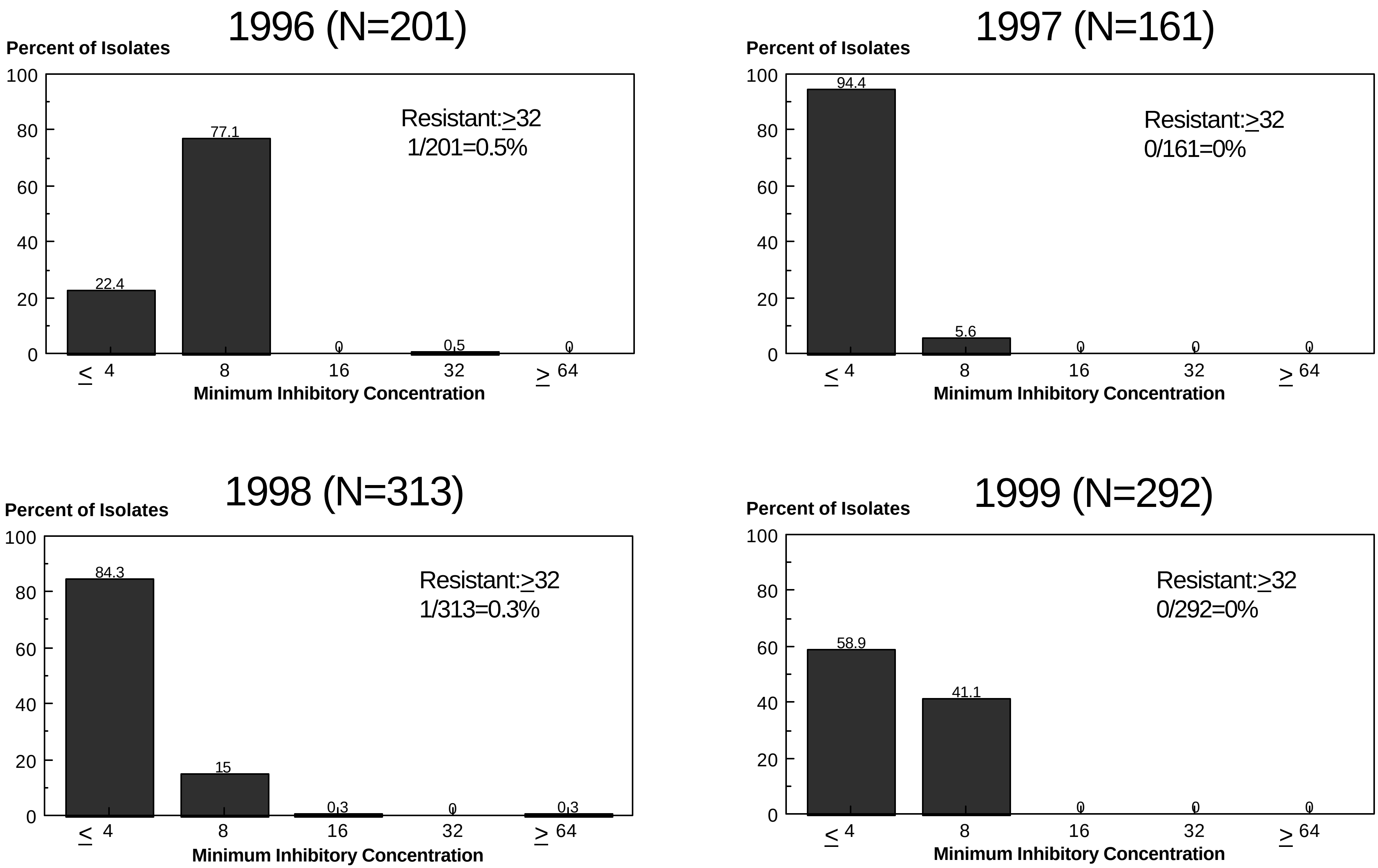

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Figure 15i. MICs for Ciprofloxacin among *E. coli* O157 isolates, 1996 - 1999

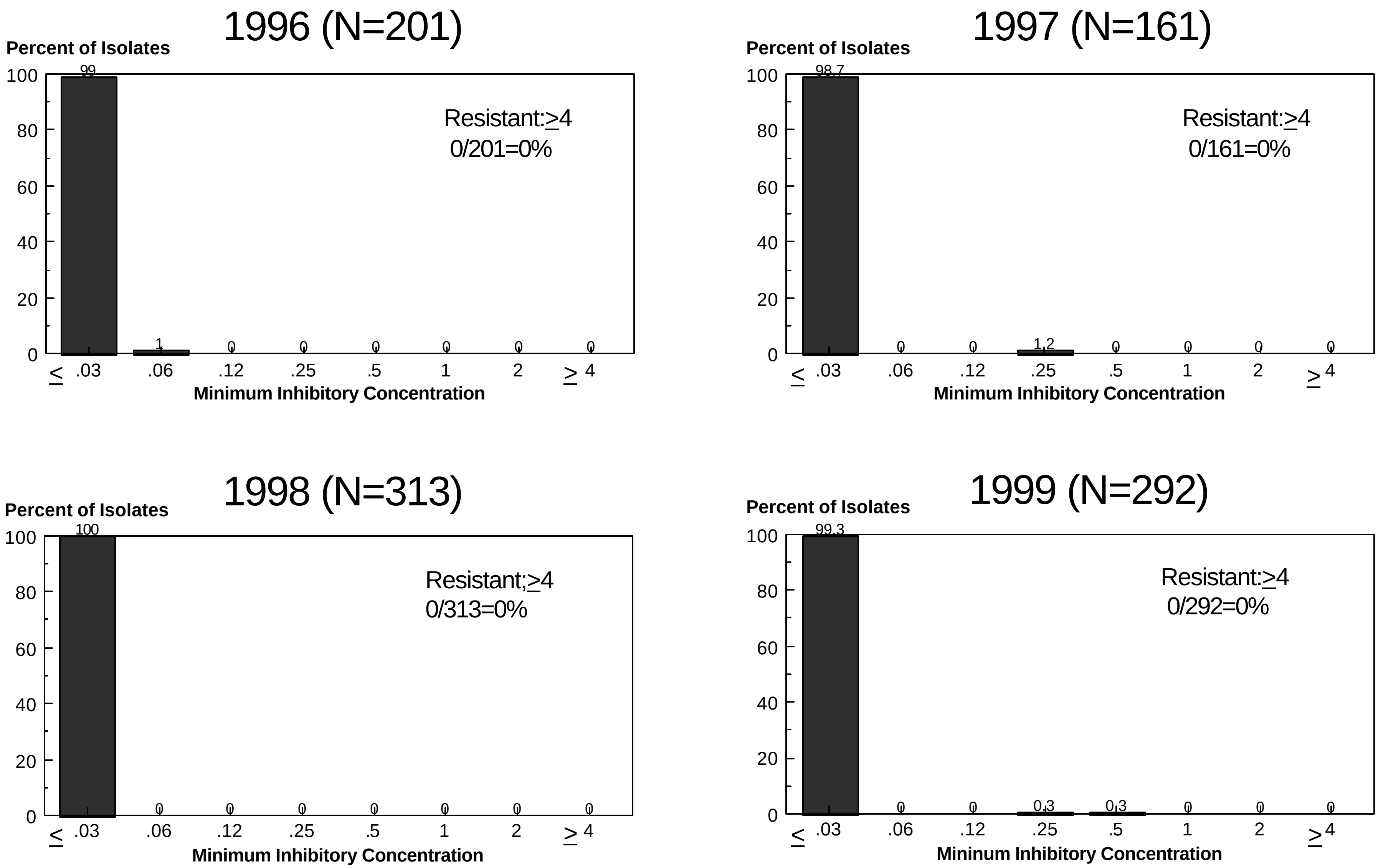

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Figure 15j. MICs for Florfenicol among *E. coli* O157 isolates, 1996 - 1999

Not tested in 1996

Not tested in 1997

Not tested in 1998

1999 (N=292)

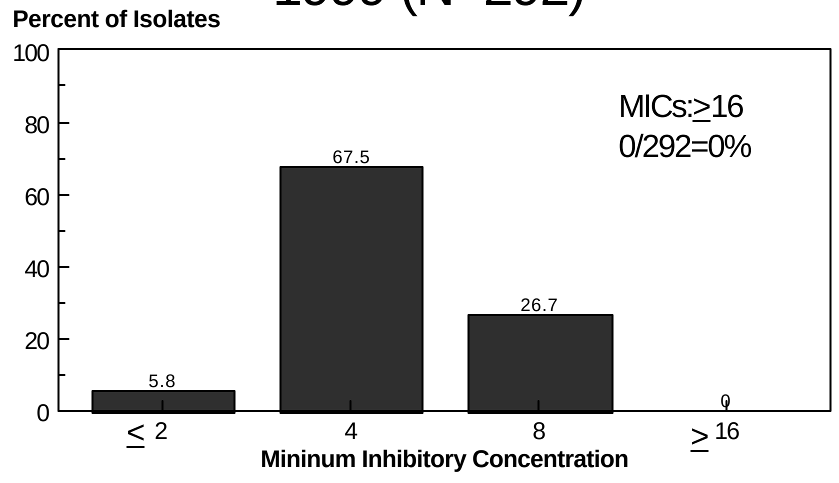

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Figure 15k. MICs for Gentamicin among *E. coli* O157 isolates, 1996 - 1999

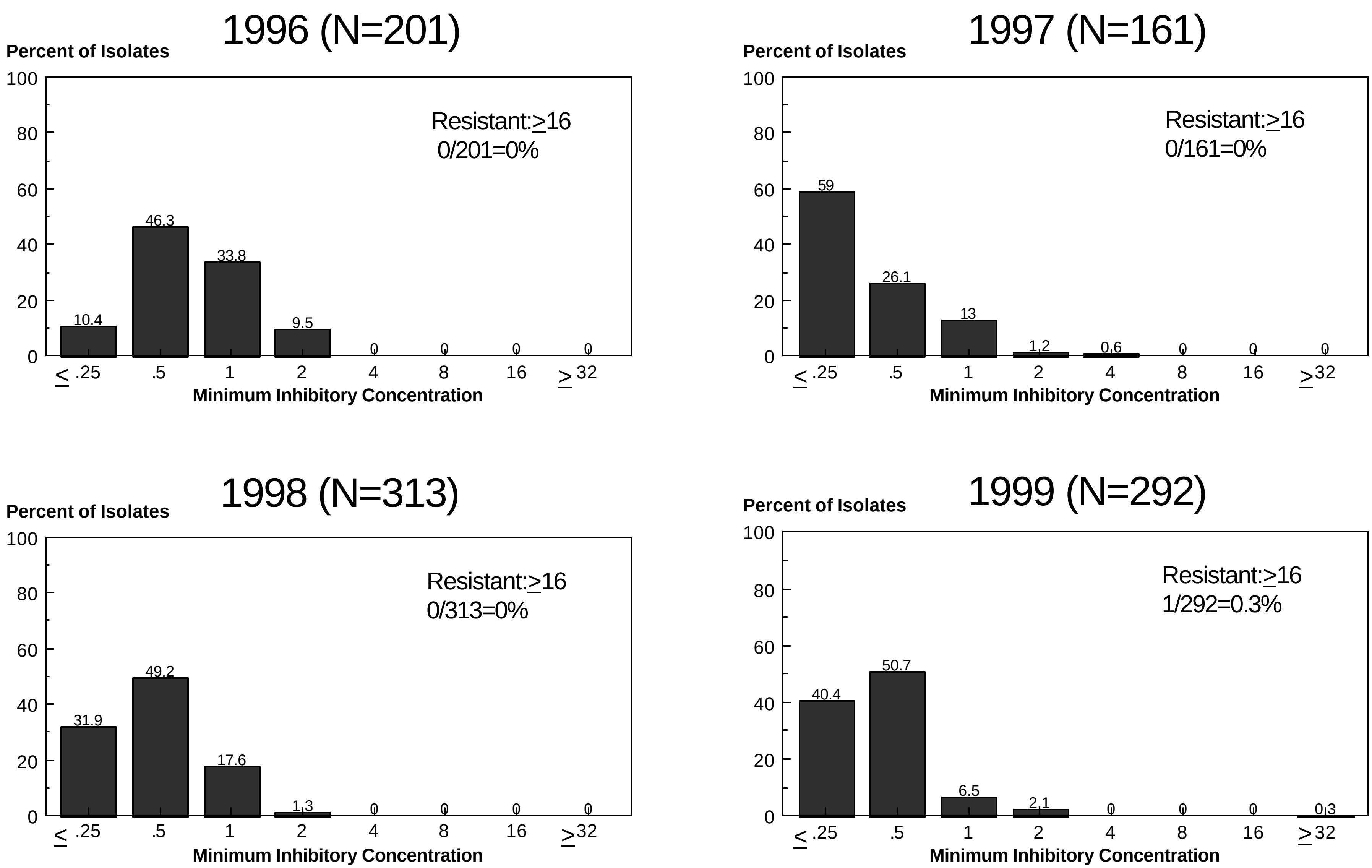

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Figure 15l. MICs for Kanamycin among *E. coli* O157 isolates, 1996 - 1999

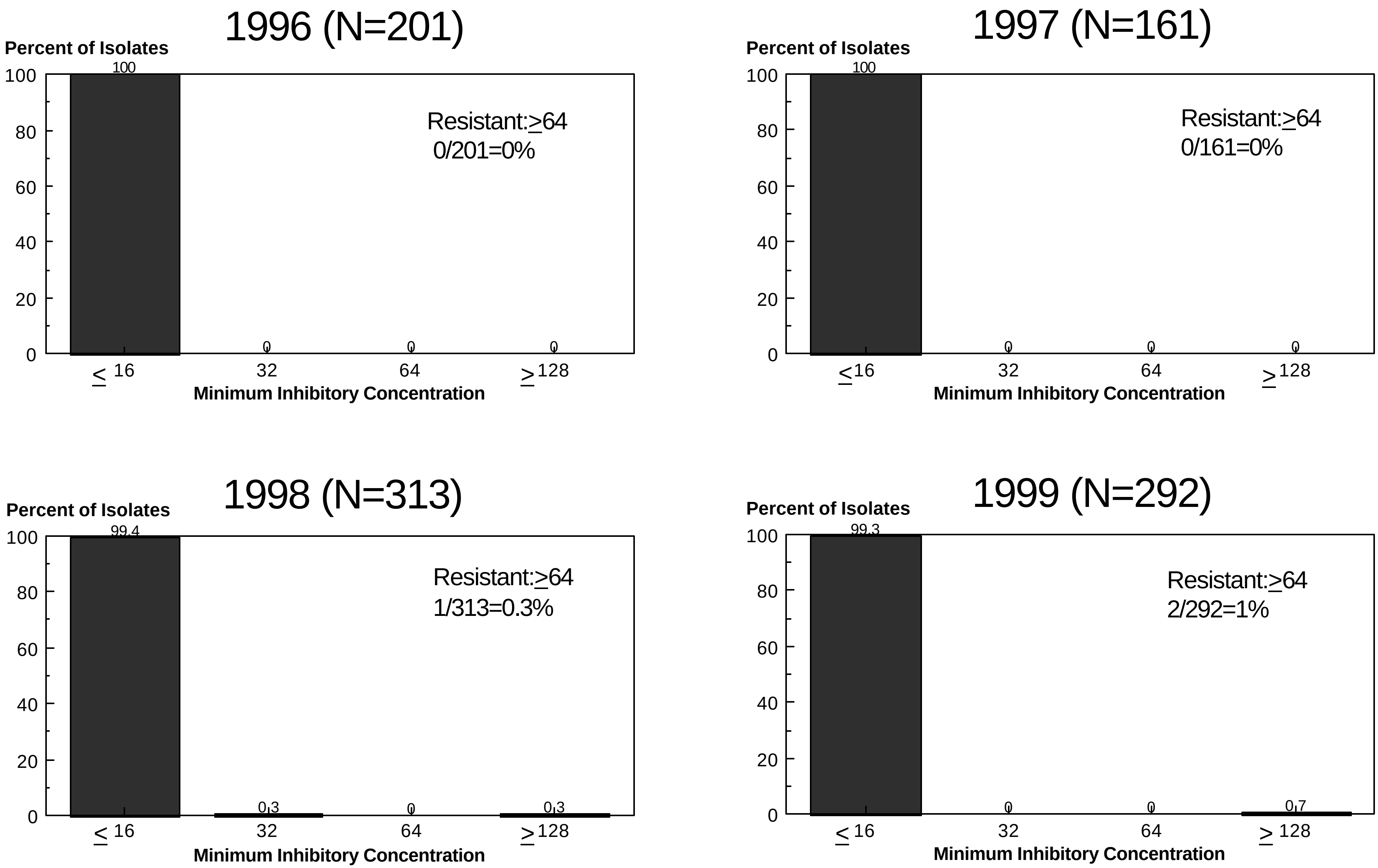

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Figure 15m. MICs for Nalidixic Acid among *E. coli* O157 isolates, 1996 - 1999

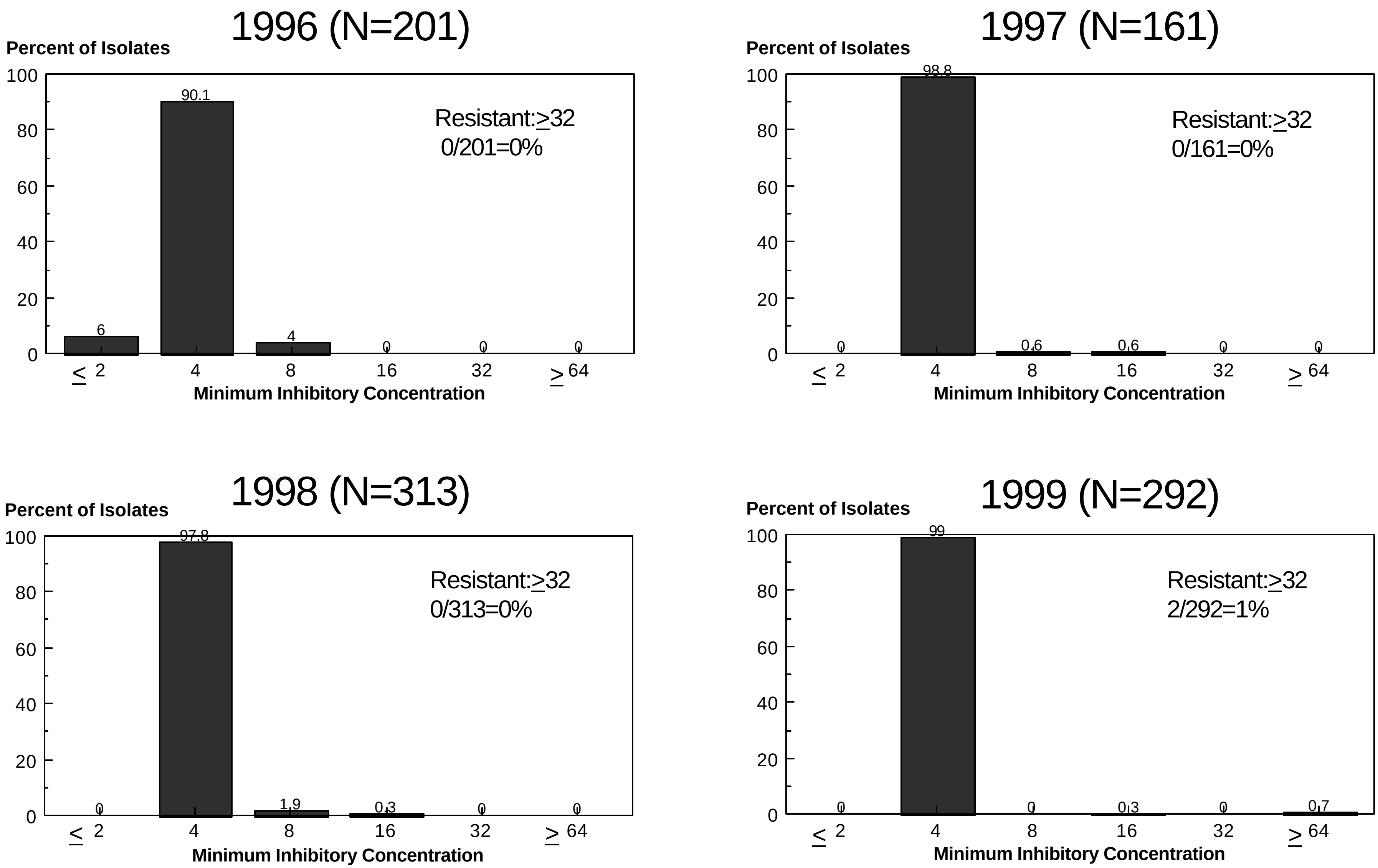

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Figure 15n. MICs for Streptomycin among *E. coli* O157 isolates, 1996 - 1999

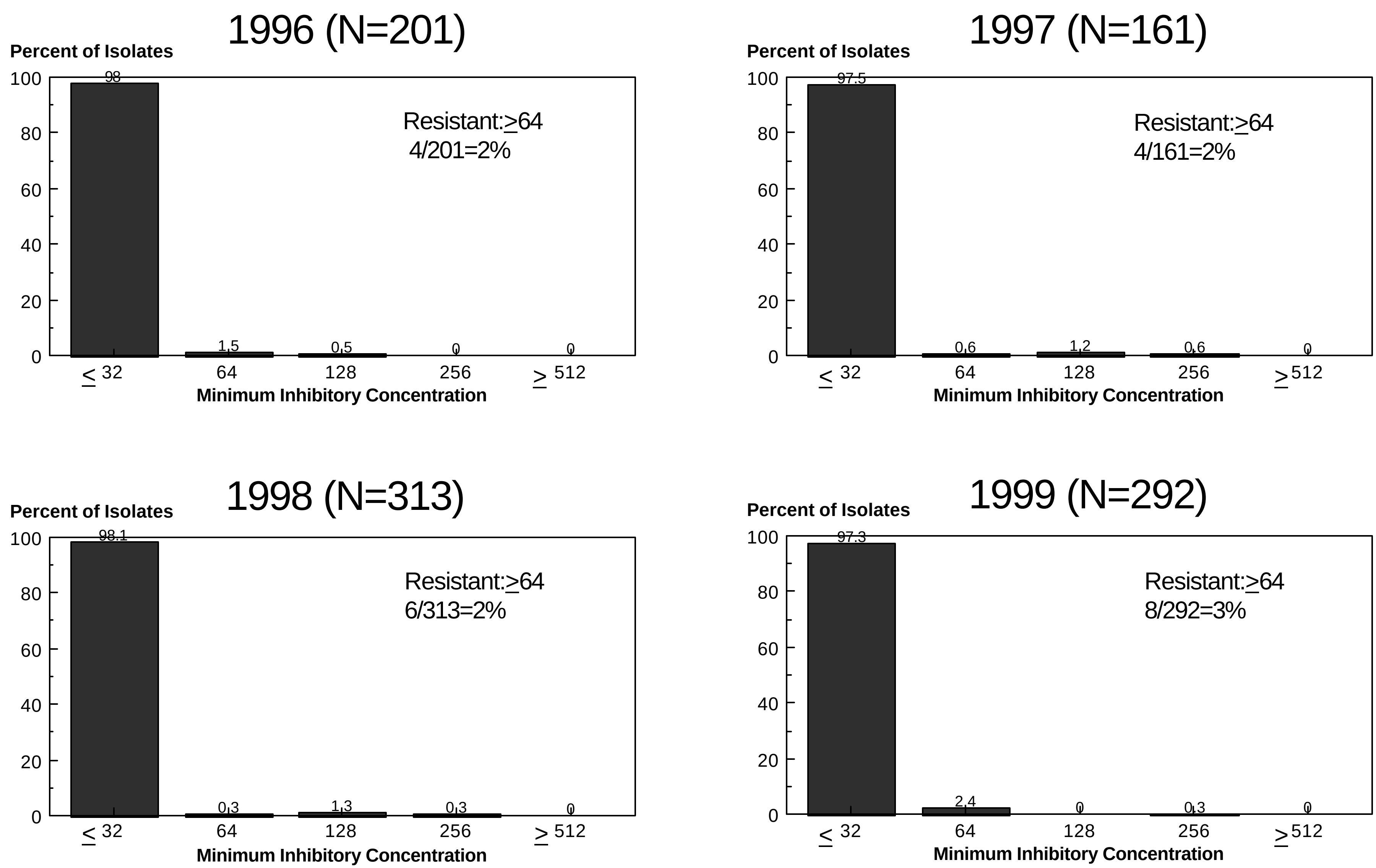

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Figure 15o. MICs for Sulfamethoxazole among *E. coli* O157 isolates, 1996 - 1999

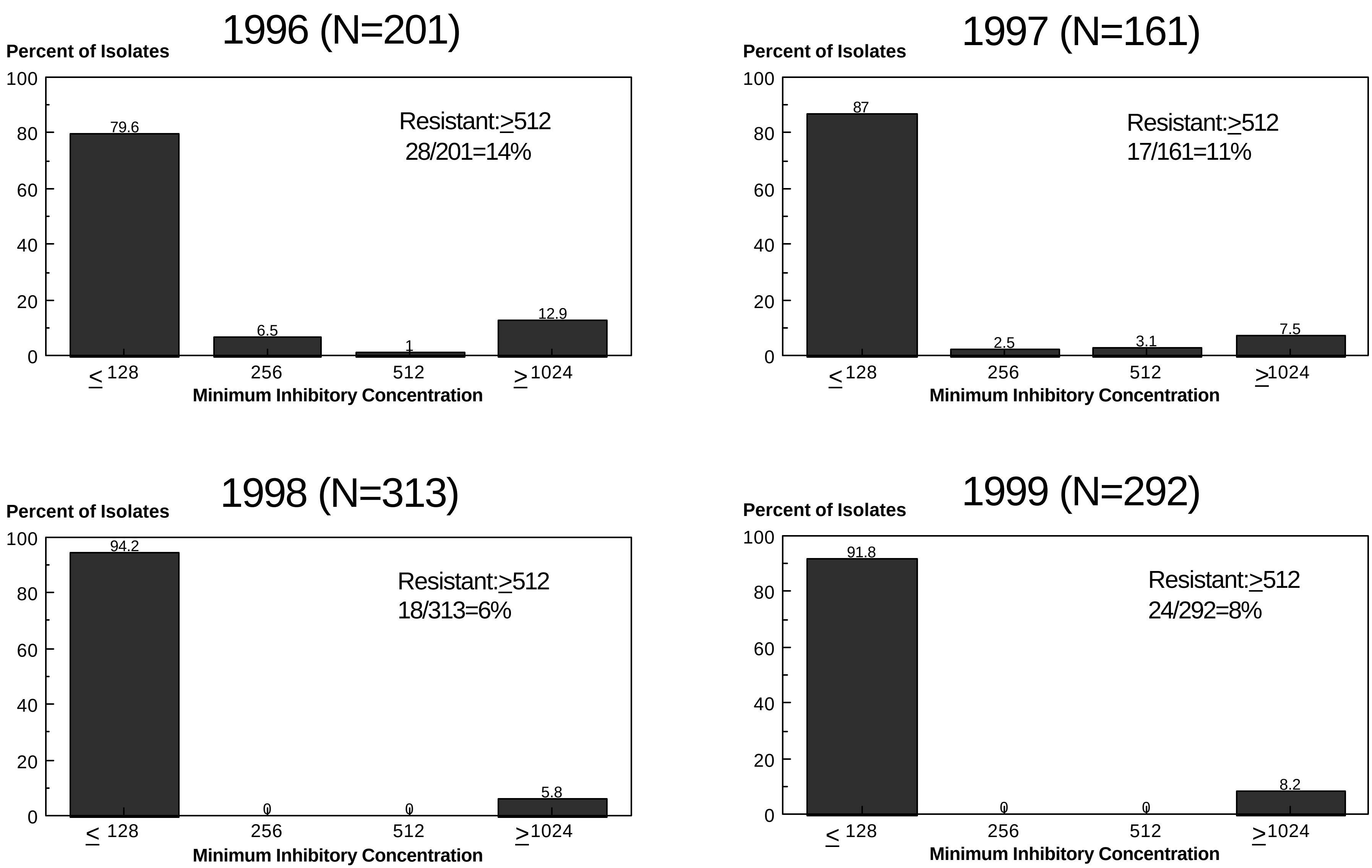

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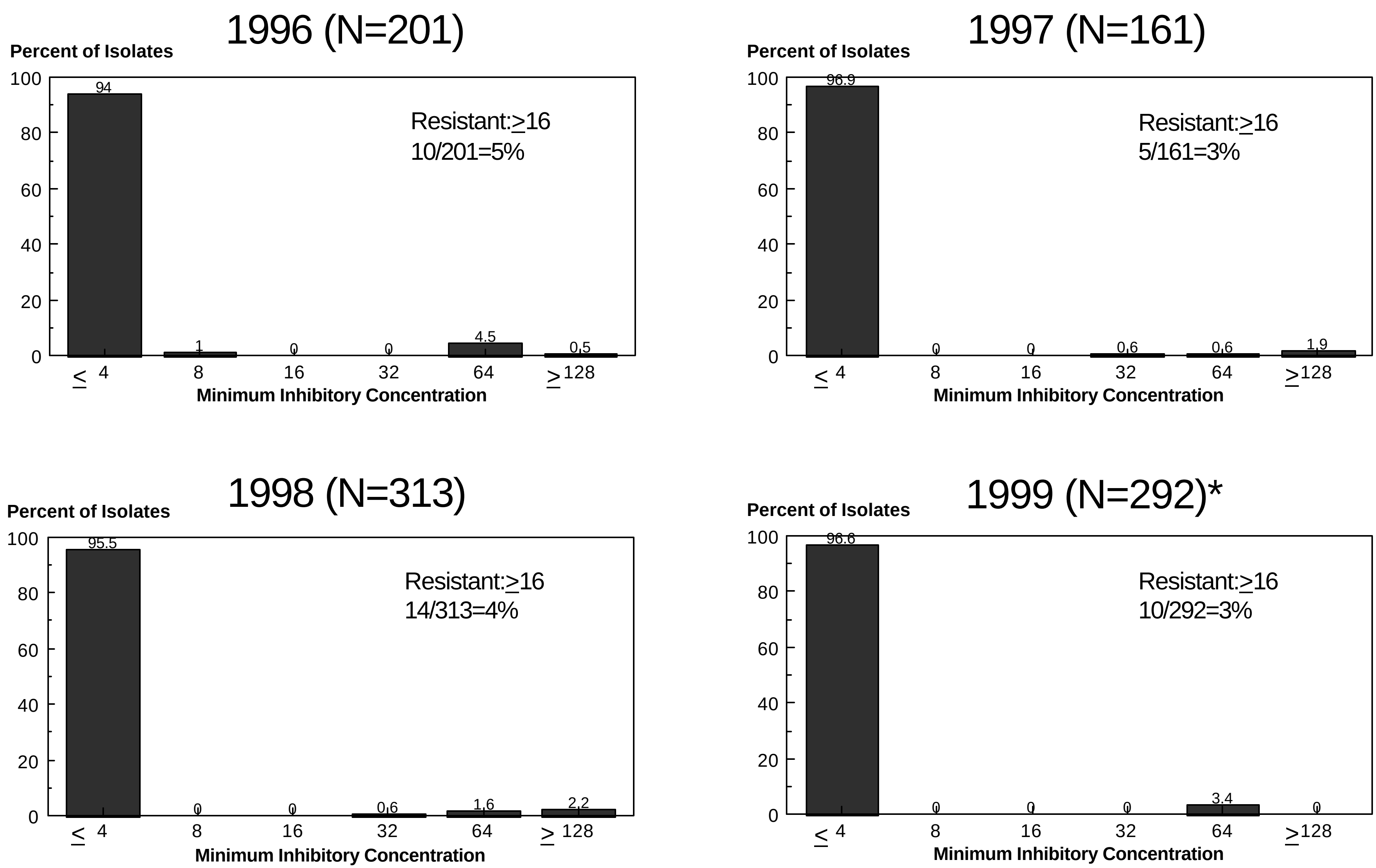
Figure 15p. MICs for Tetracycline among *E. coli* O157 isolates, 1996 - 1999



* Maximum MIC dilution for 1999 was 32 ug/ml. All resistant isolates had a MIC >32 ug/ml.

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Figure 15q. MICs for Trimethoprim-Sulfamethoxazole among *E. coli* O157 isolates, 1996 - 1999

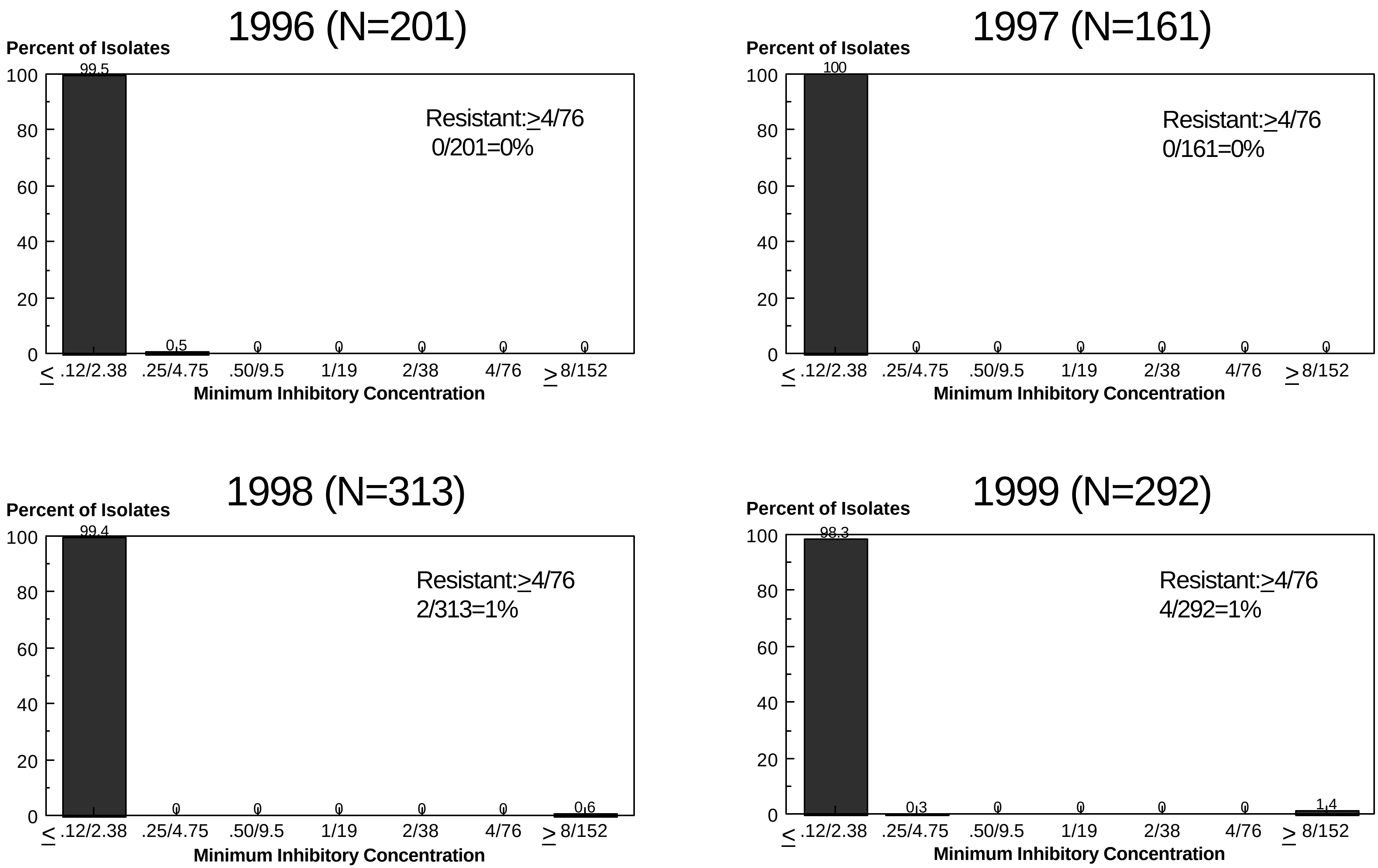

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Figure 16. Resistance among *Campylobacter* isolates, 1997- 1999

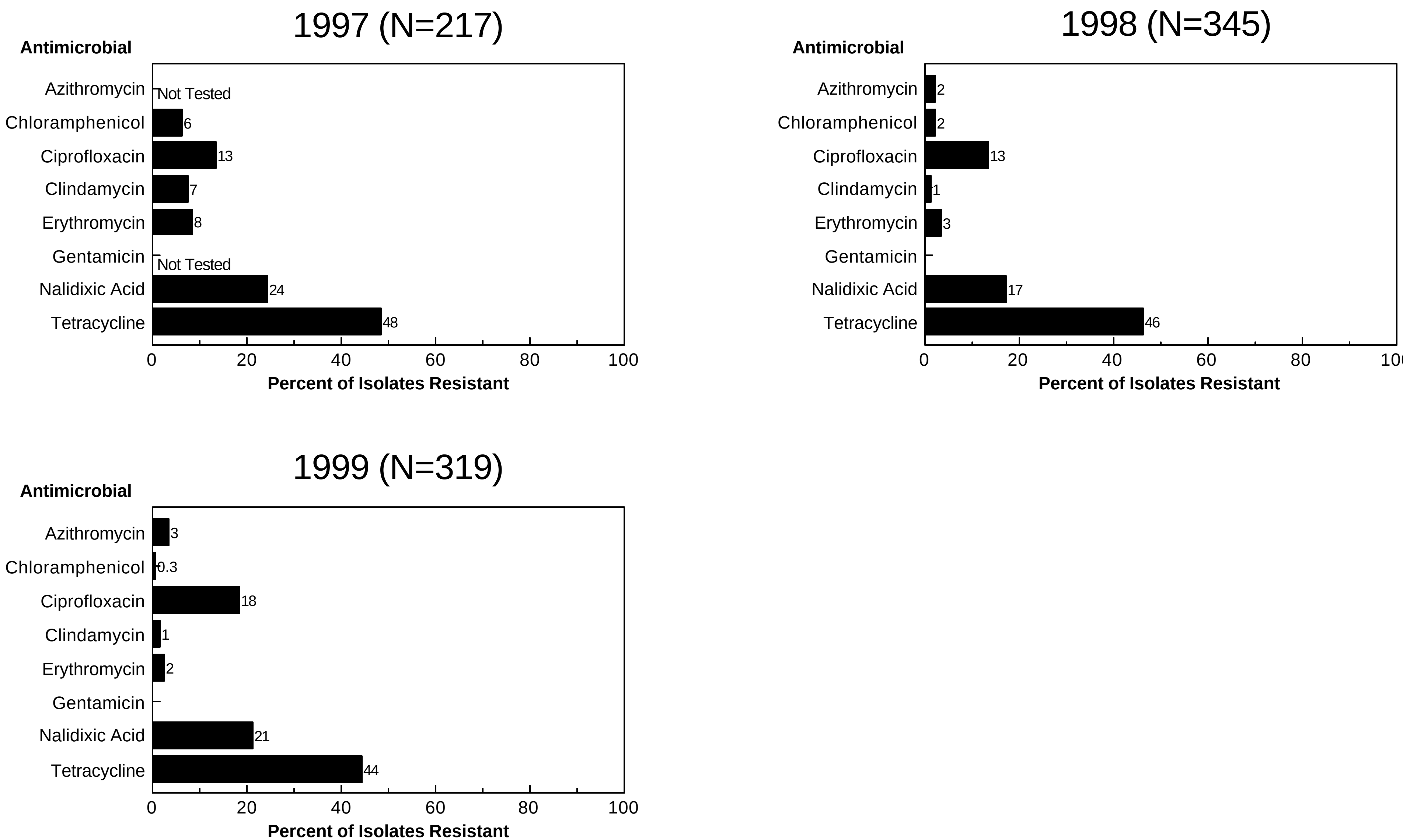

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Figure 17a. Resistance among *Campylobacter jejuni* isolates, 1997- 1999

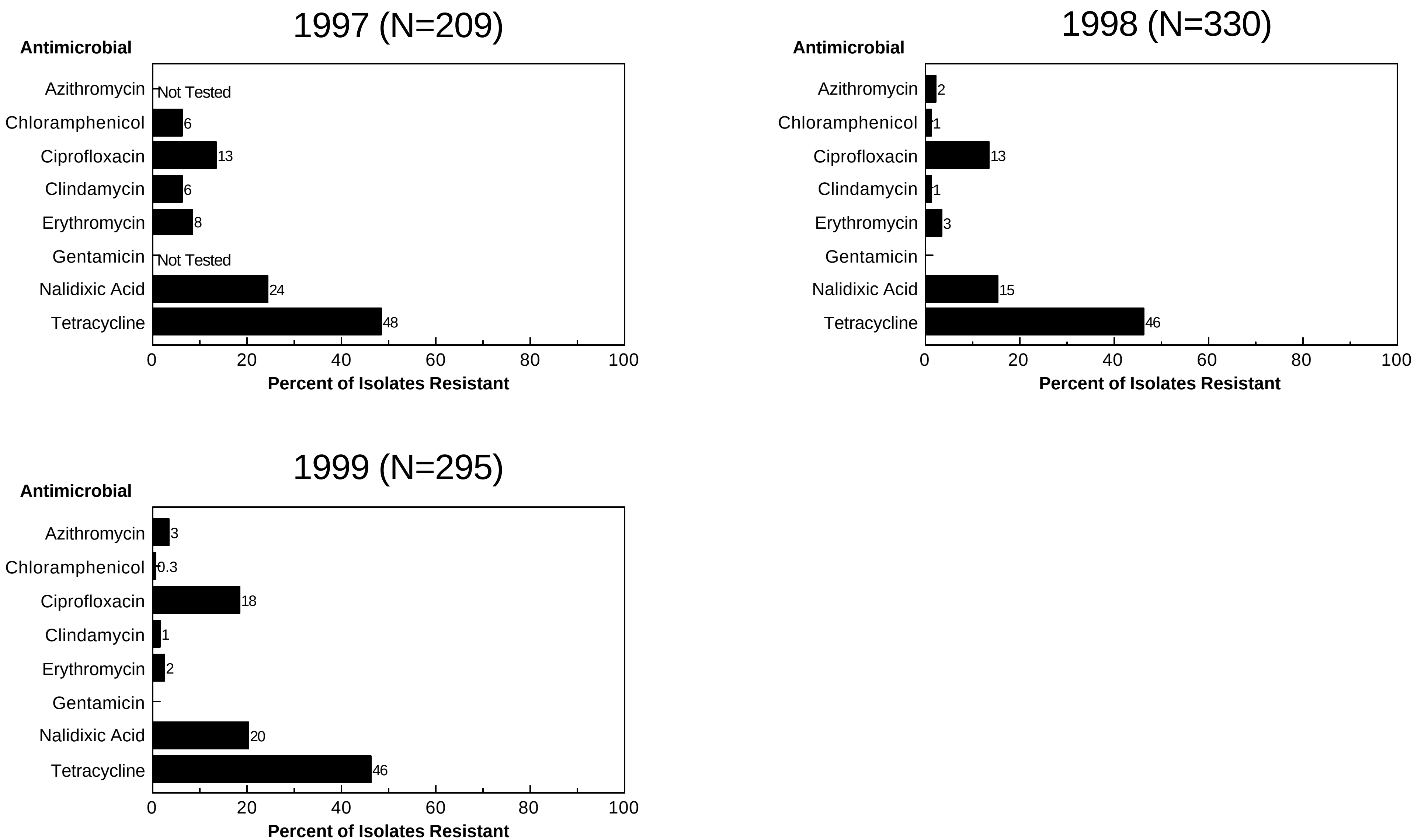

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Figure 17b. Resistance among *Campylobacter coli* isolates, 1997- 1999

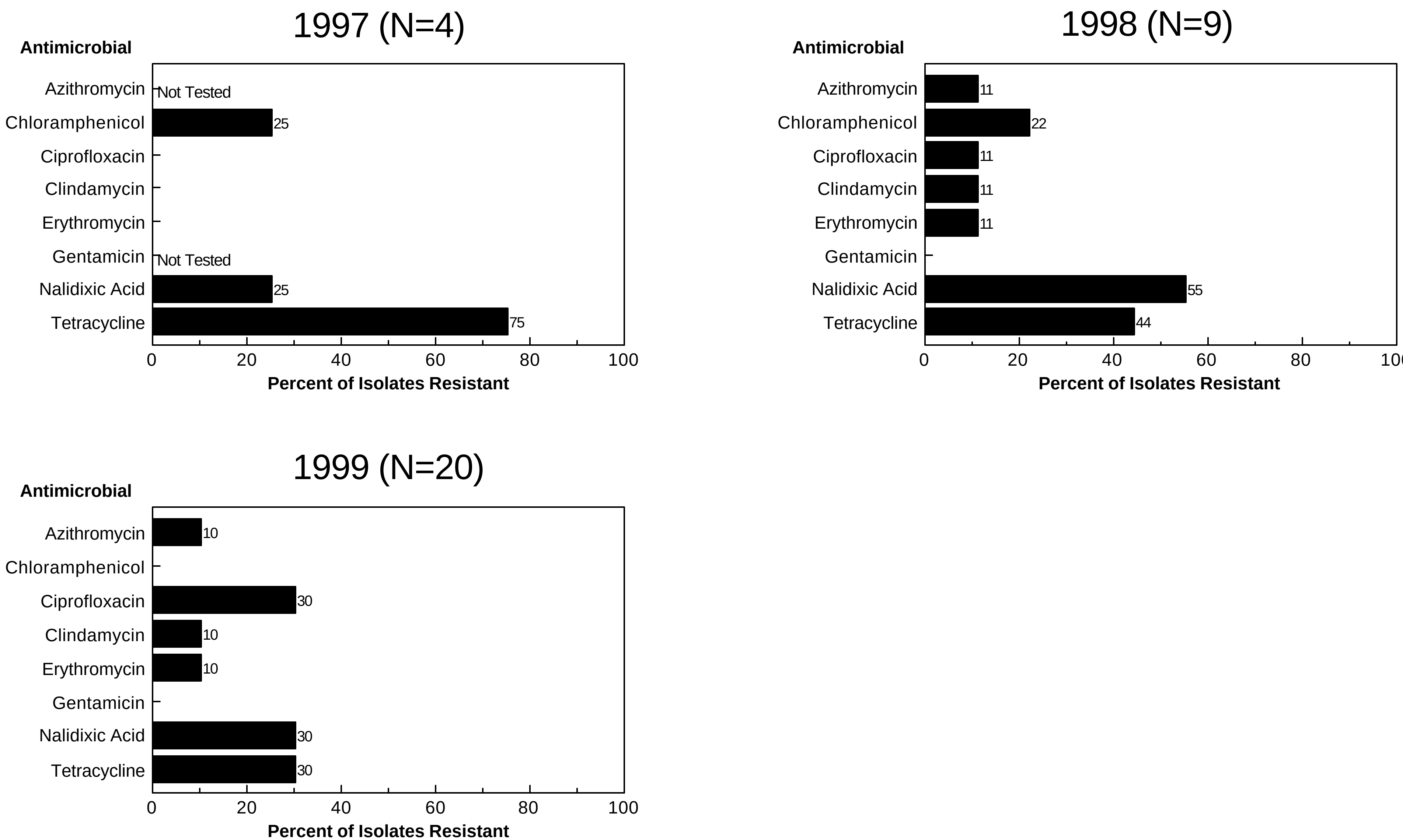

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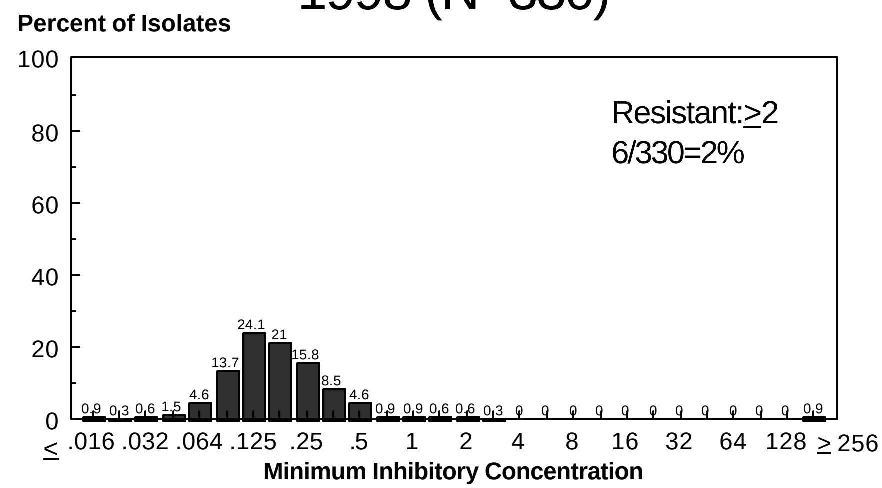
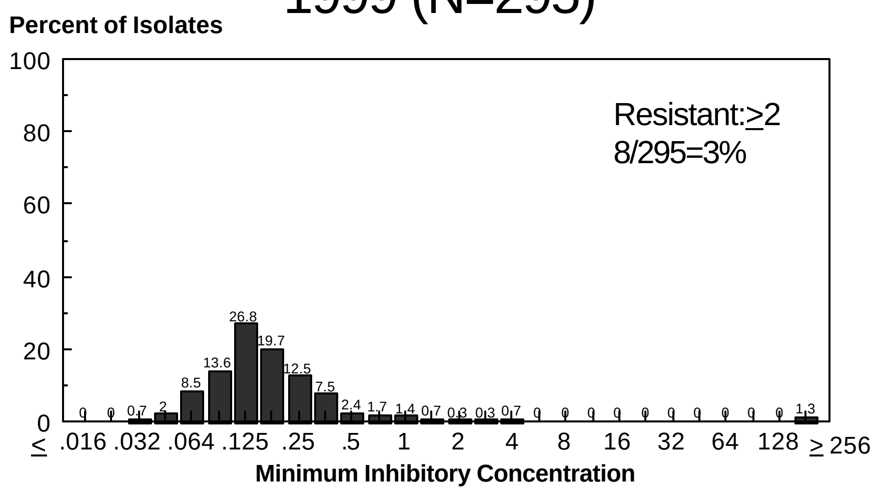
Figure 18a. MICs for Azithromycin among *Campylobacter jejuni* isolates, 1997 - 1999

Not tested in 1997

1998 (N=330)

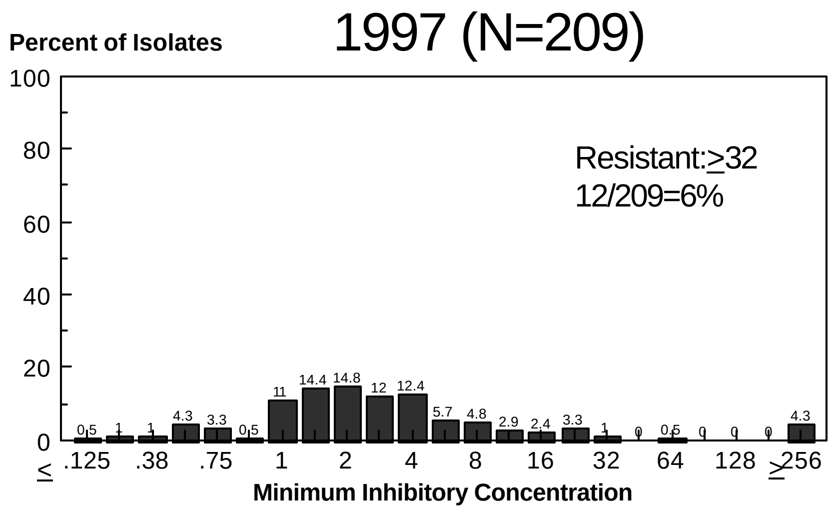


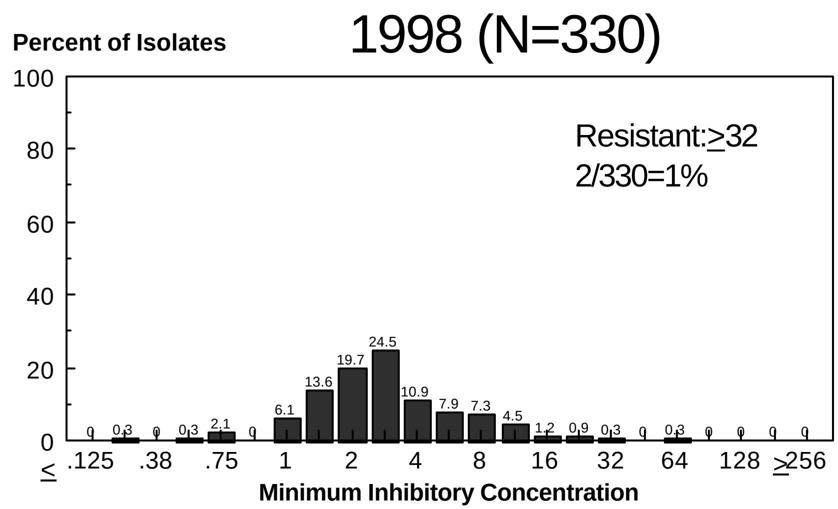
1999 (N=295)



National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 18b. MICs for Chloramphenicol among *Campylobacter jejuni* isolates, 1997 - 1999





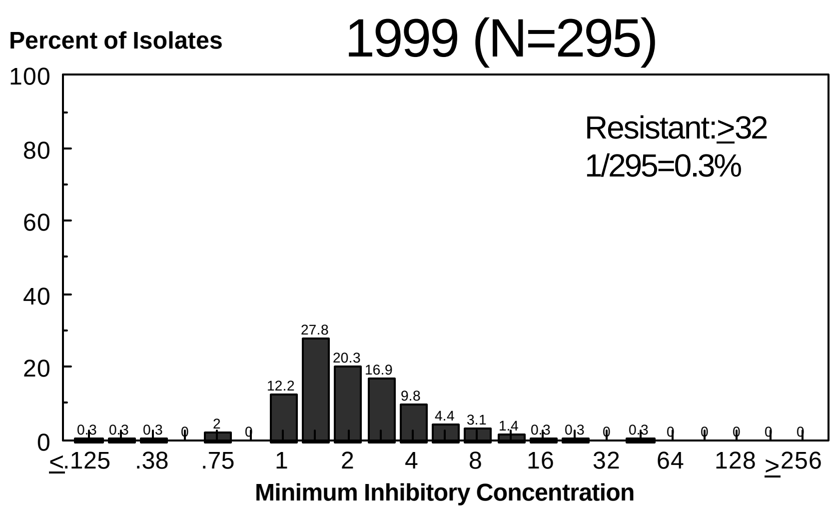


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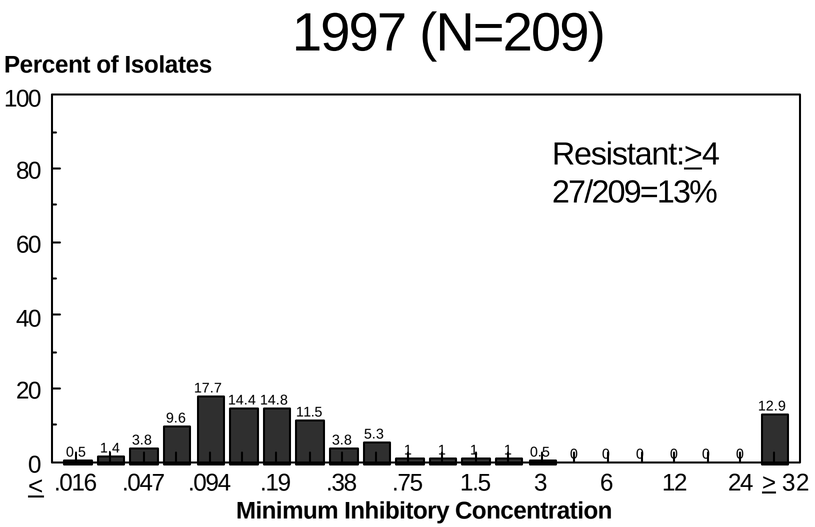
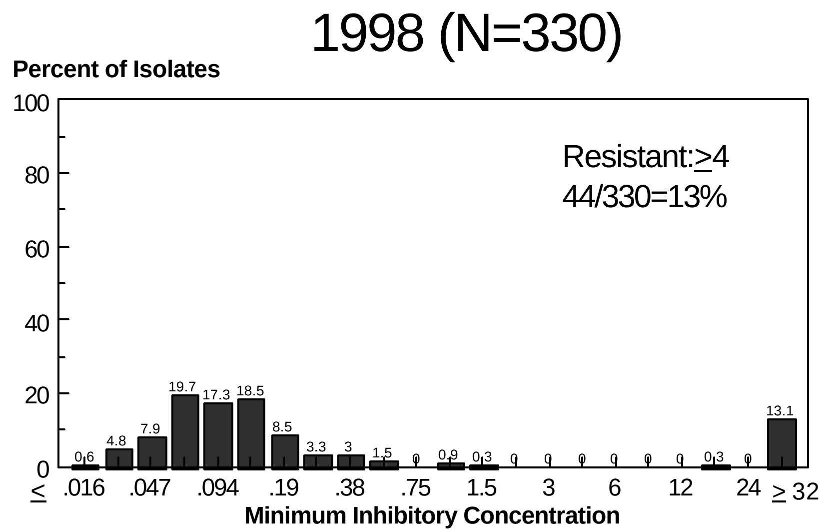
Figure 18c. MICs for Ciprofloxacin among *Campylobacter jejuni* isolates, 1997 - 1999





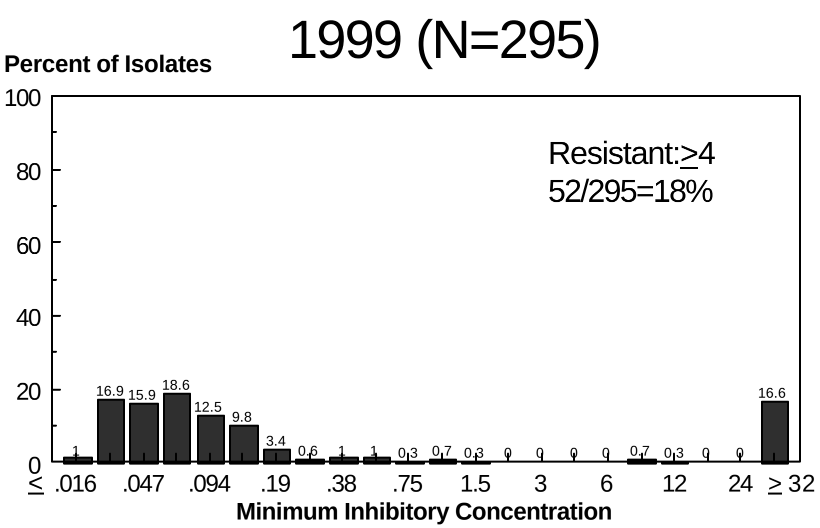


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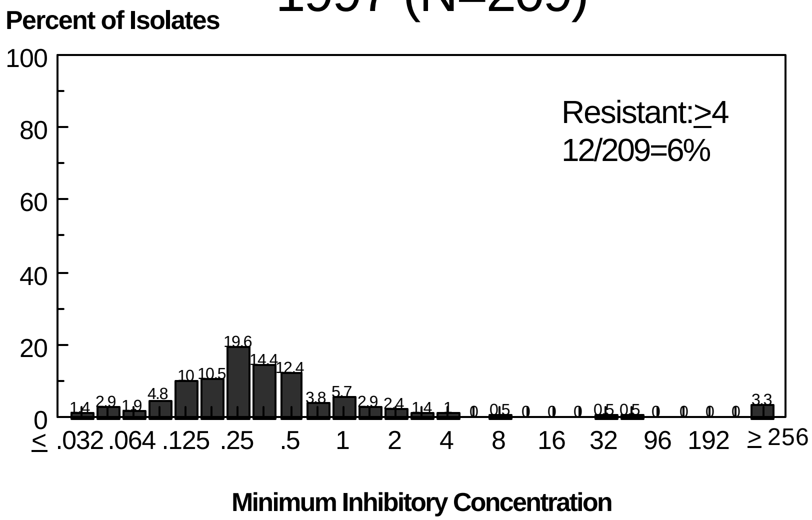
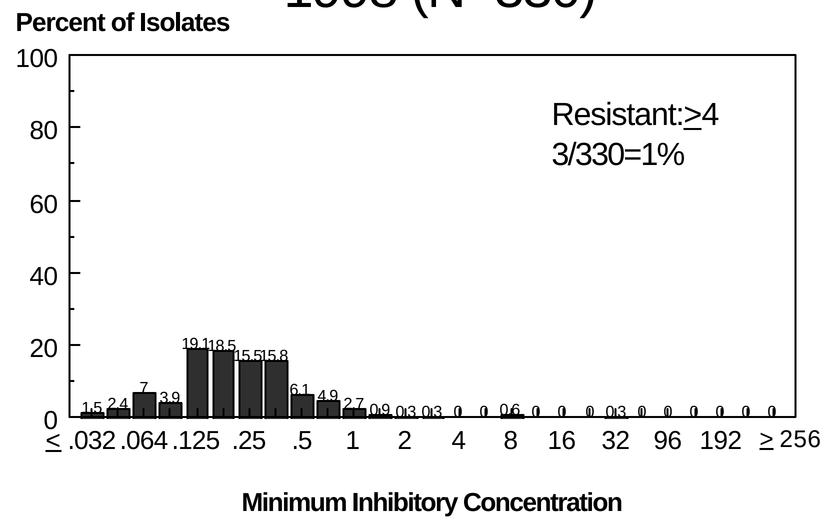
Figure 18d. MICs for Clindamycin among *Campylobacter jejuni* isolates, 1997 - 1999

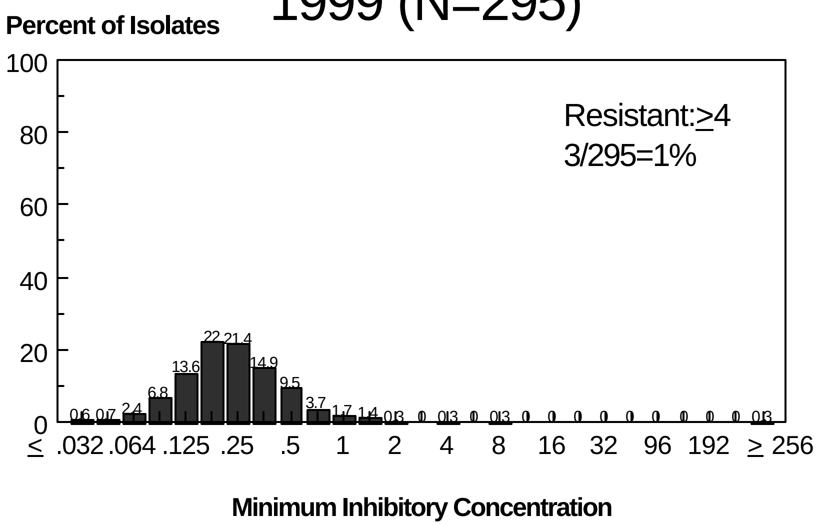
1997 (N=209)



1998 (N=330)



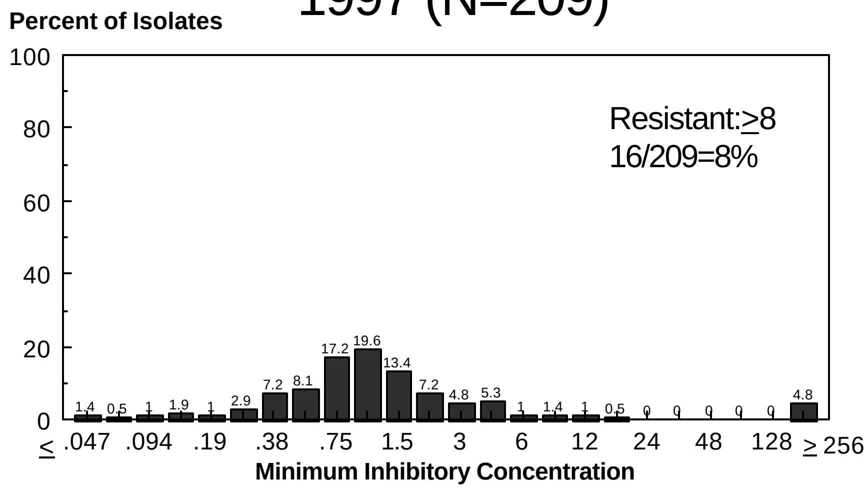
1999 (N=295)



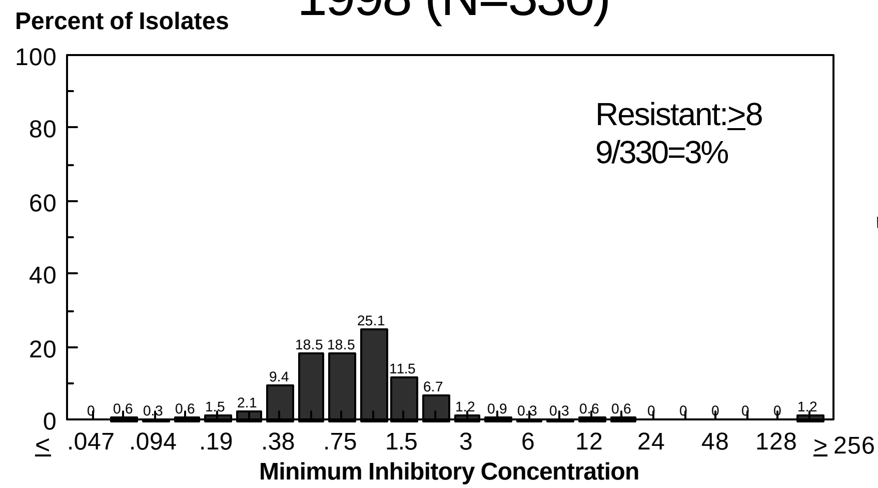
National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 18e. MICs for Erythromycin among *Campylobacter jejuni* isolates, 1997 - 1999

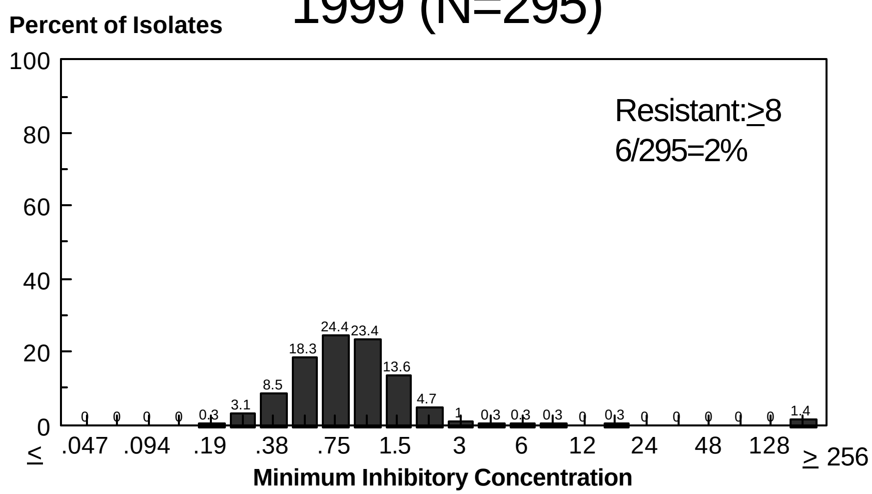
1997 (N=209)



1998 (N=330)



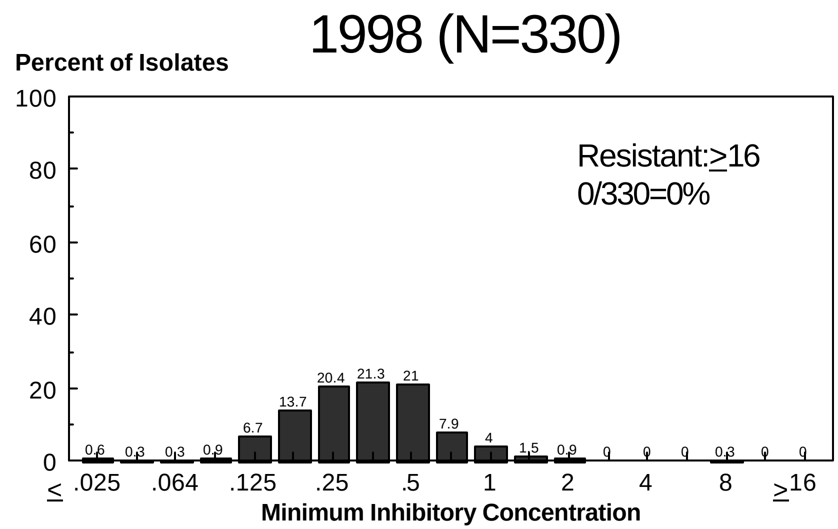
1999 (N=295)

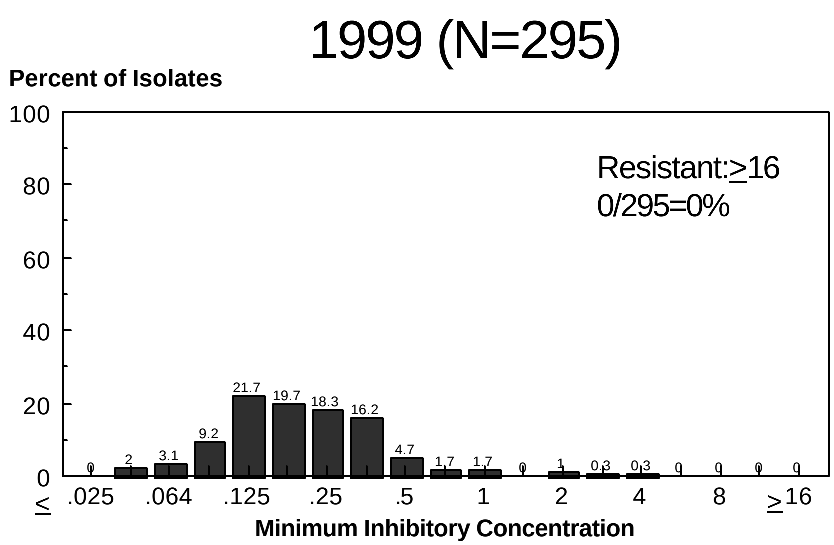


National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 18f. MICs for Gentamicin among *Campylobacter jejuni* isolates, 1997 - 1999

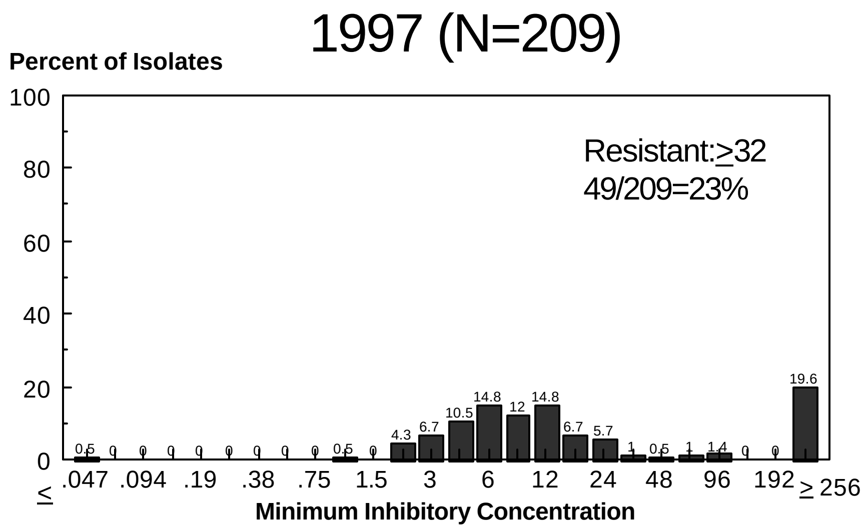
Not tested in 1997

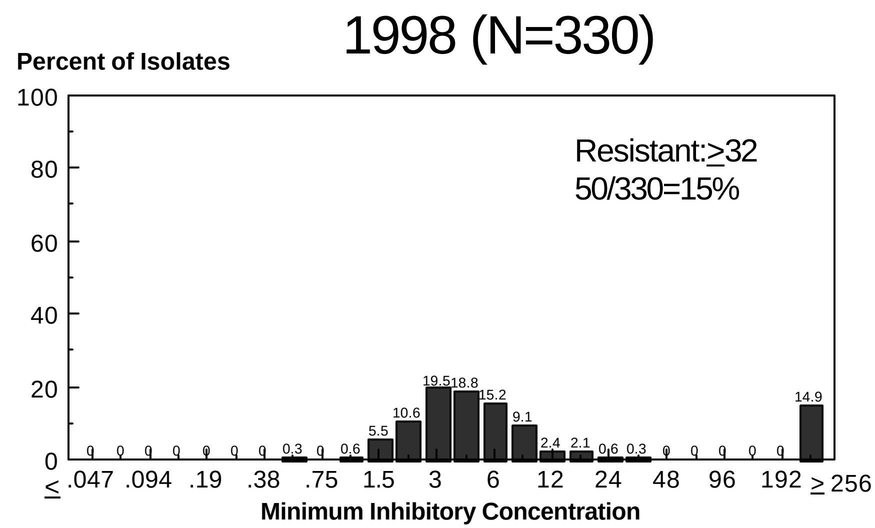




National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 18g. MICs for Nalidixic Acid among *Campylobacter jejuni* isolates, 1997 - 1999





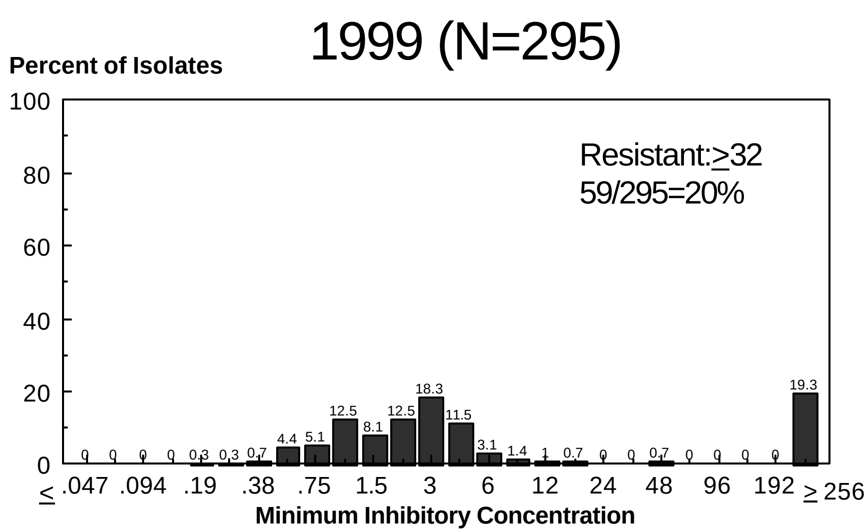


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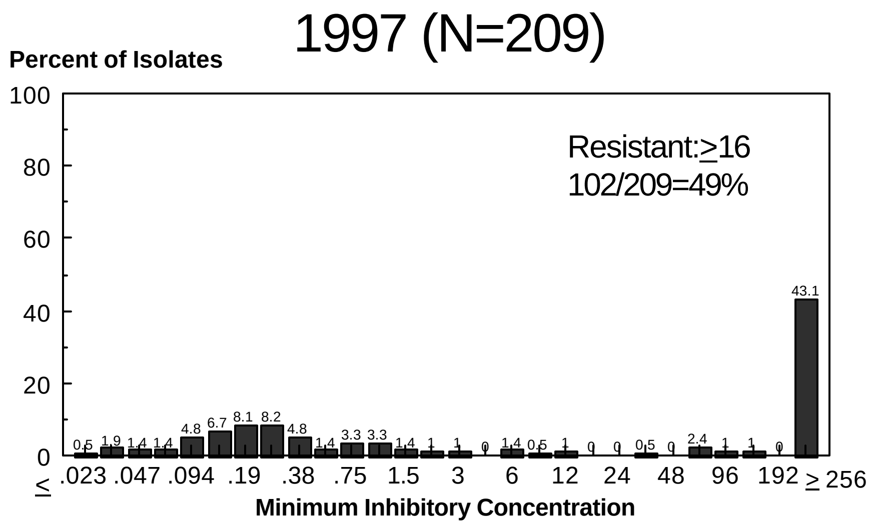
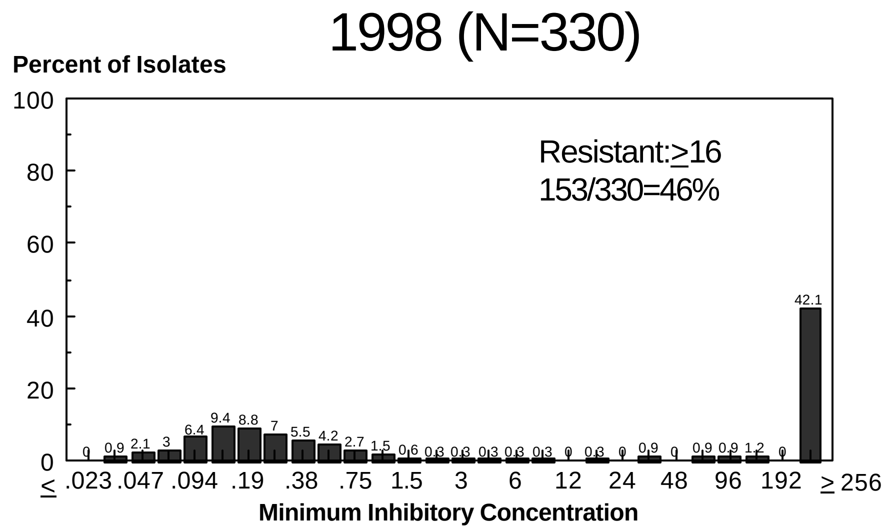
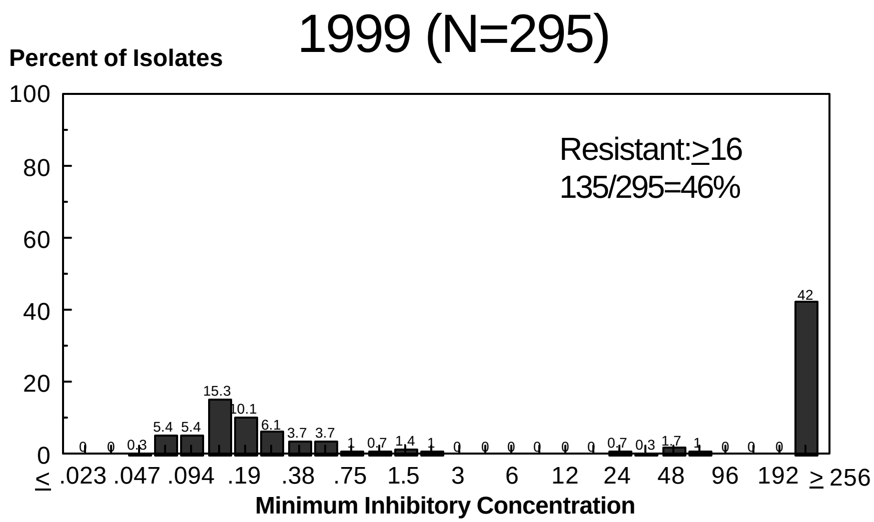
Figure 18h. MICs for Tetracycline among *Campylobacter jejuni* isolates, 1997 - 1999







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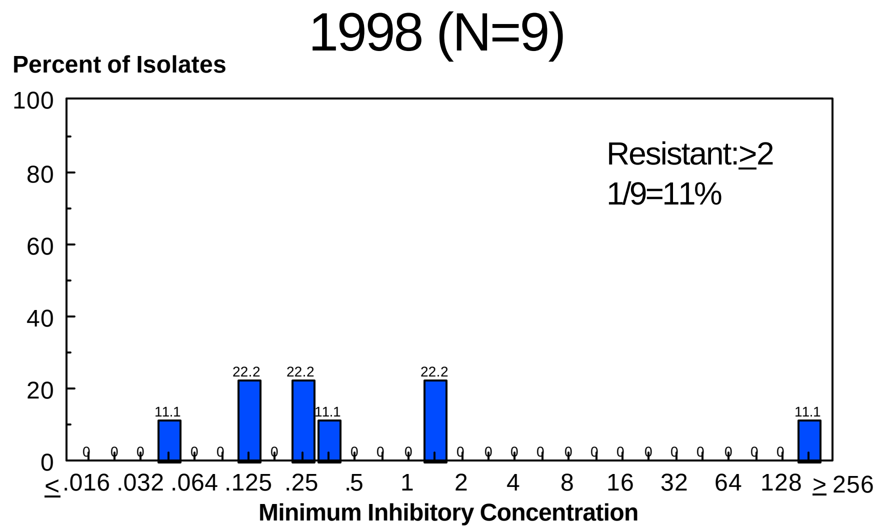
National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 19a. MICs for Azithromycin among *Campylobacter coli* isolates, 1997 - 1999

Not tested in 1997



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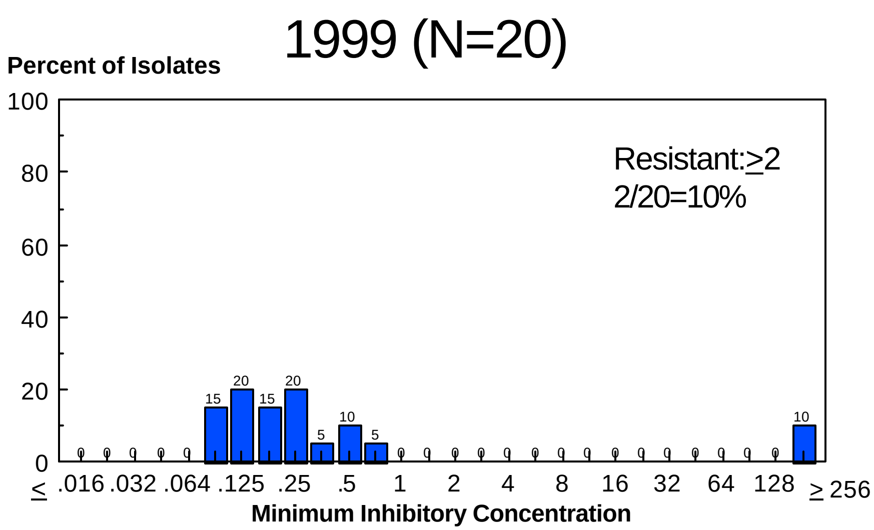
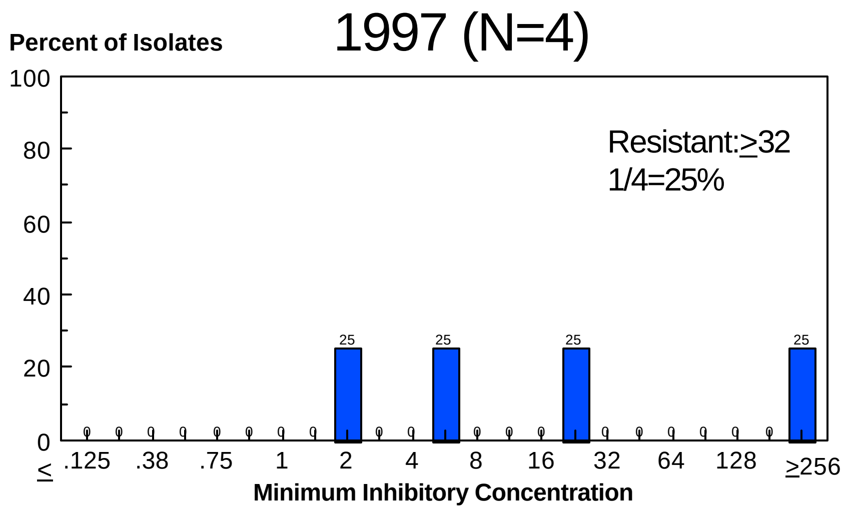
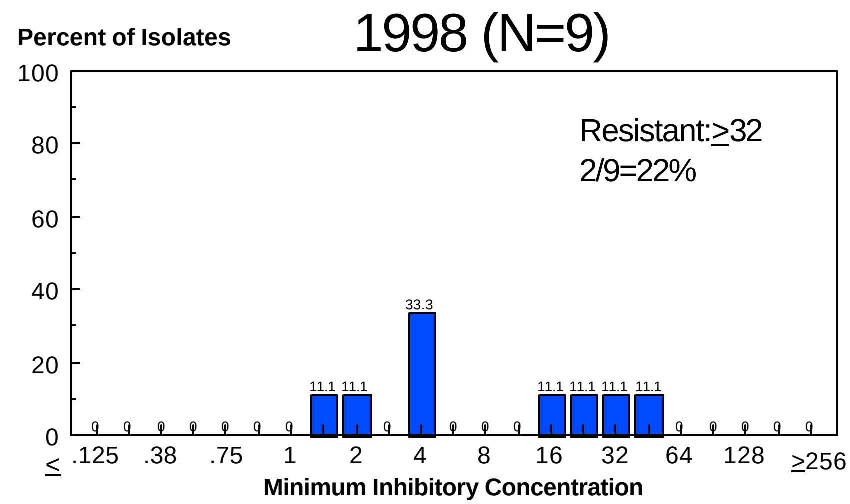
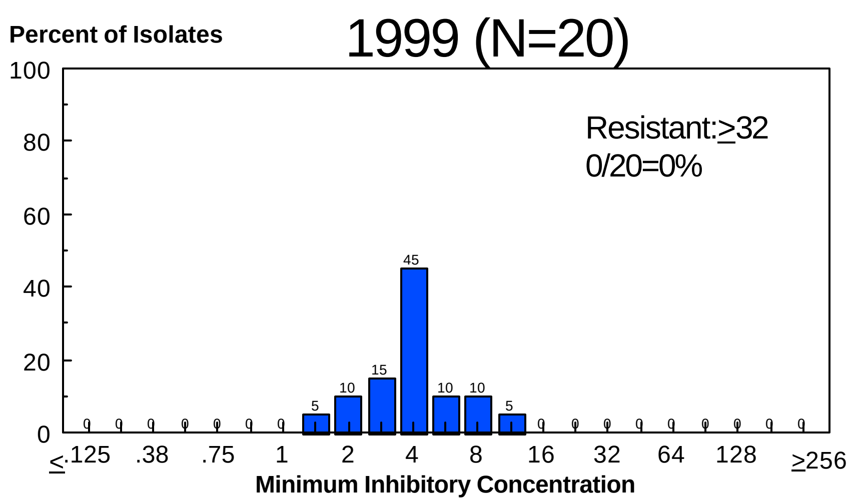


National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 19b. MICs for Chloramphenicol among *Campylobacter coli* isolates, 1997 - 1999



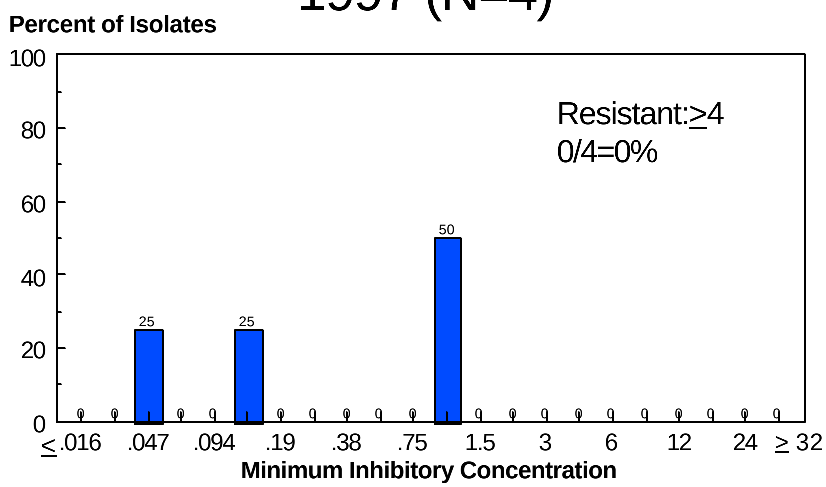




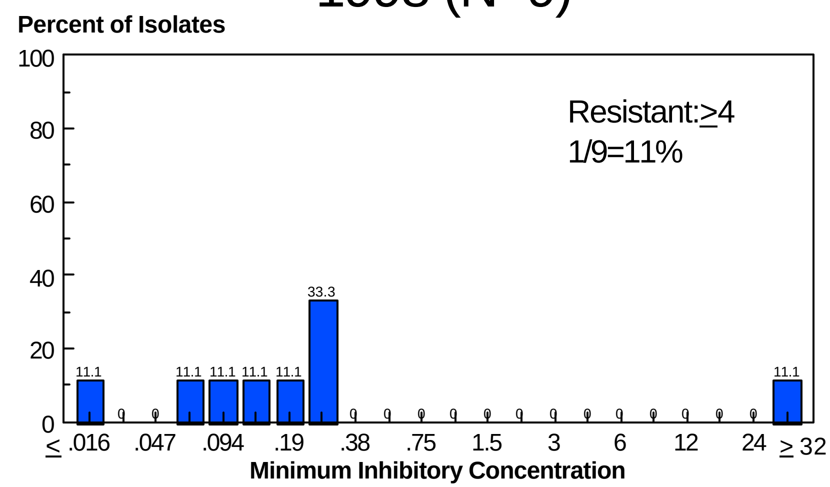
National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 19c. MICs for Ciprofloxacin among *Campylobacter coli* isolates, 1997 - 1999

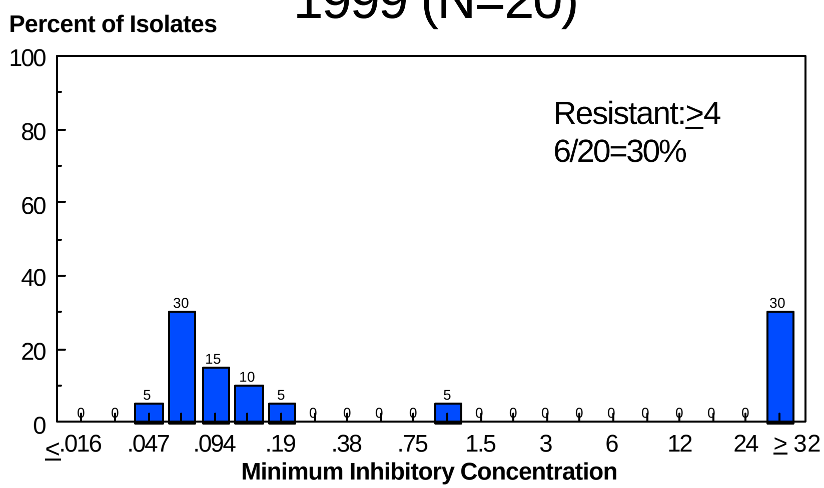
1997 (N=4)



1998 (N=9)

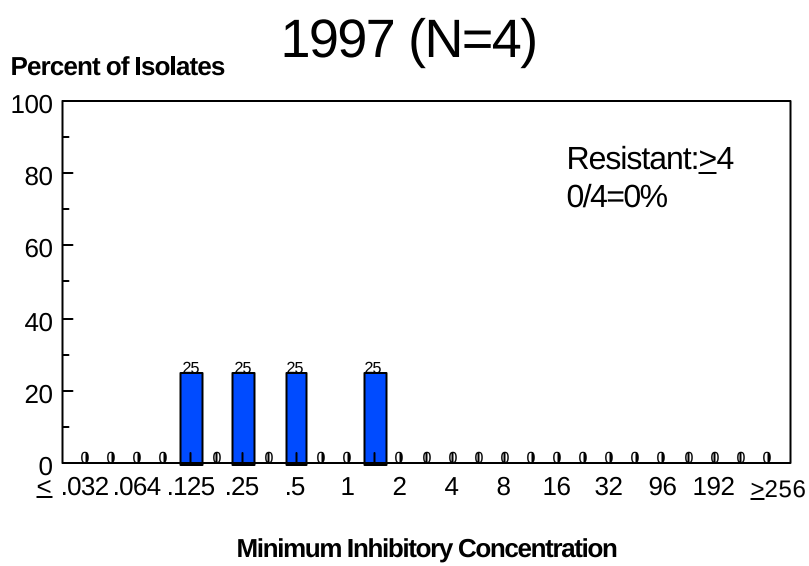


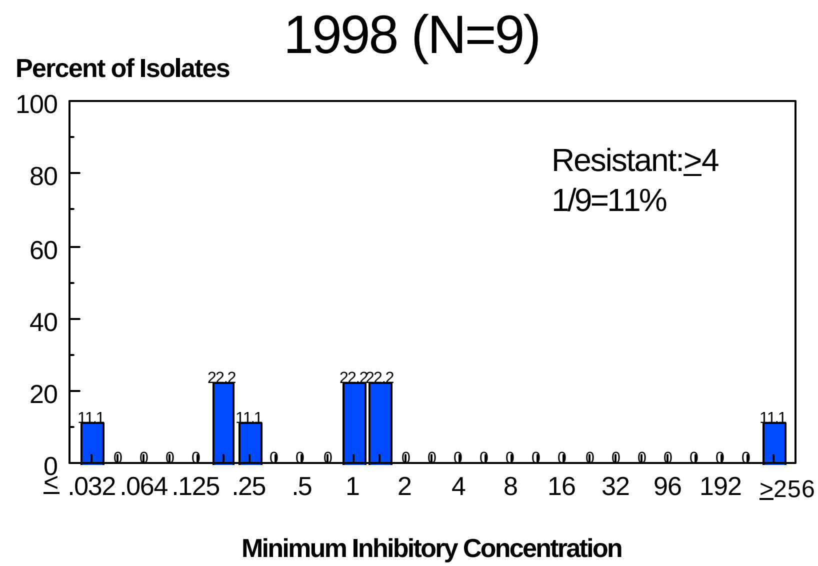
1999 (N=20)

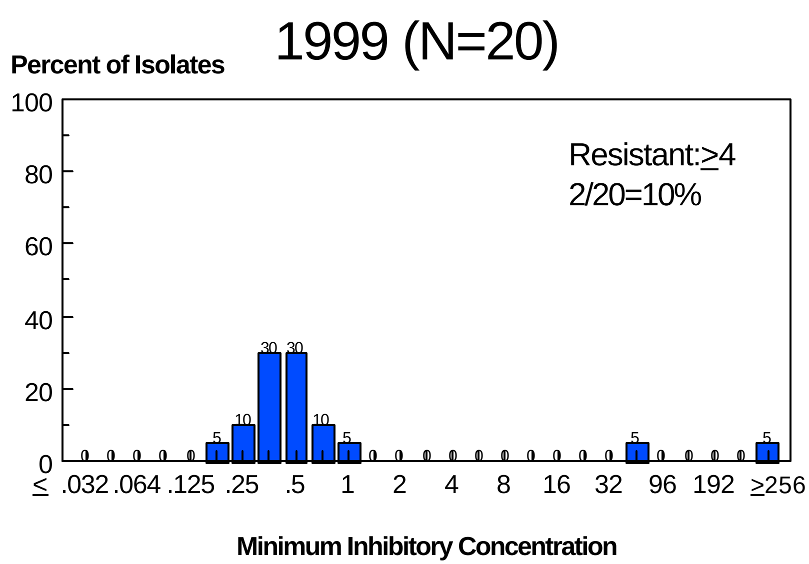


National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 19d. MICs for Clindamycin among *Campylobacter coli* isolates, 1997 - 1999

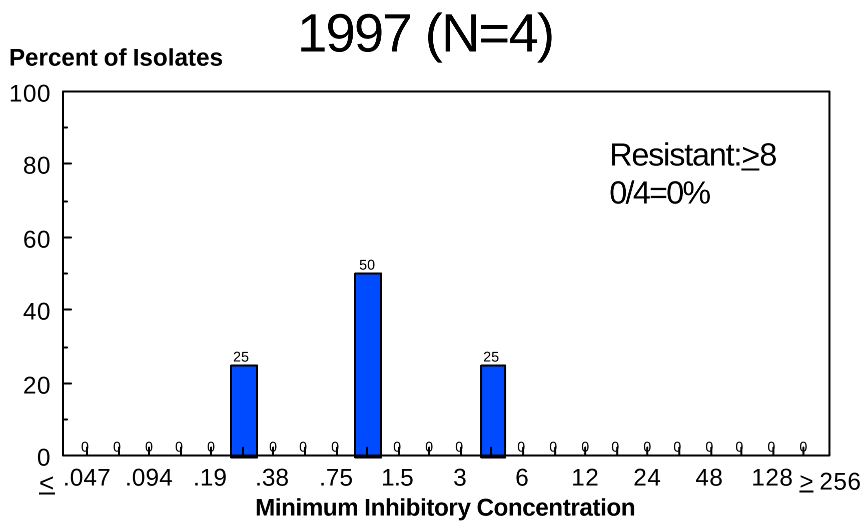


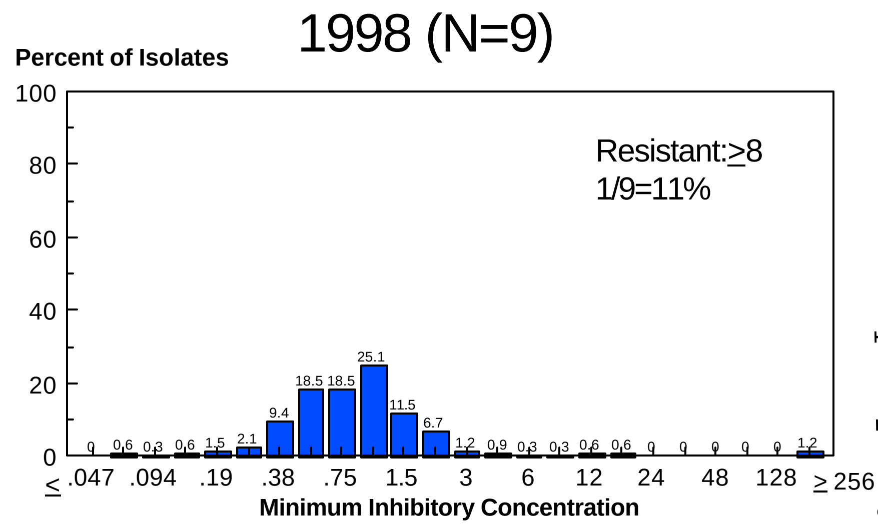




National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 19e. MICs for Erythromycin among *Campylobacter coli* isolates, 1997 - 1999





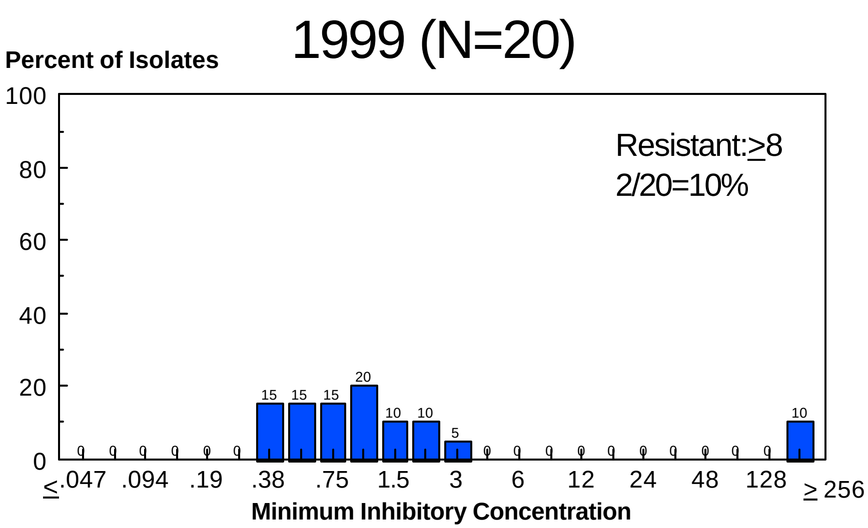


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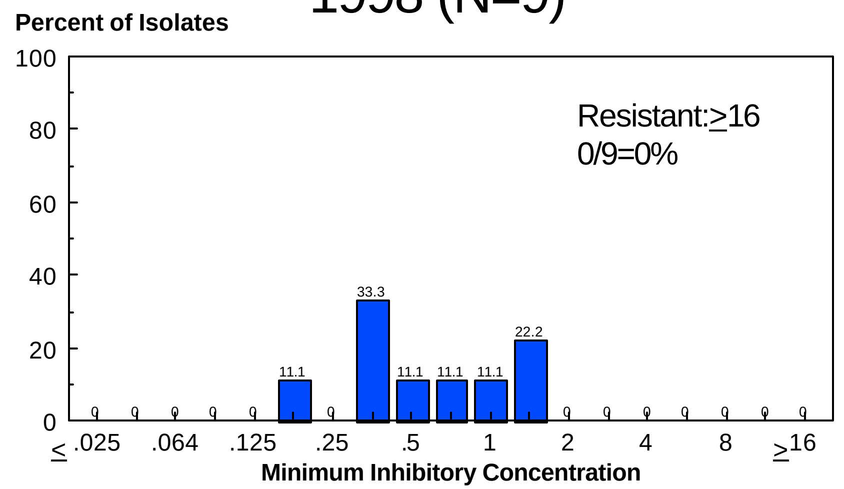
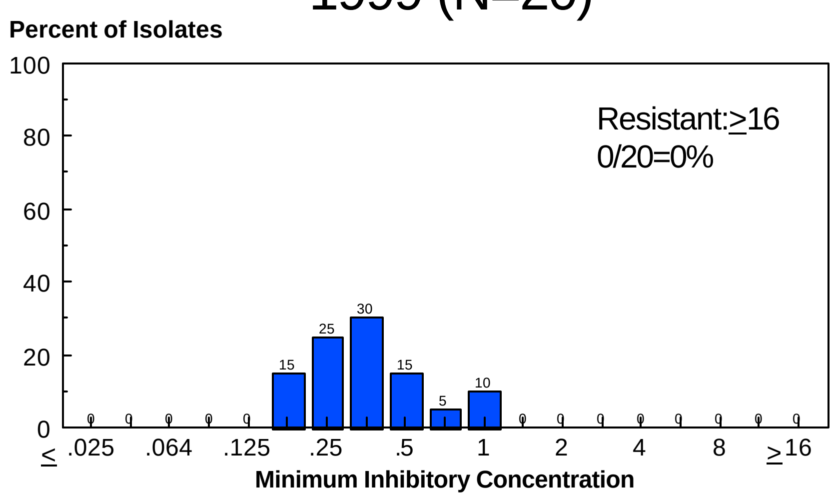
Figure 19f. MICs for Gentamicin among *Campylobacter coli* isolates, 1997 - 1999

Not tested in 1997

1998 (N=9)

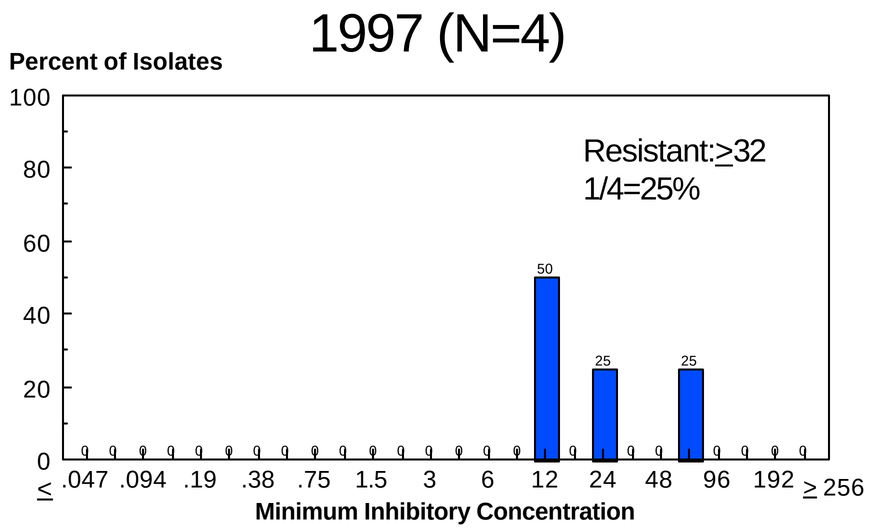


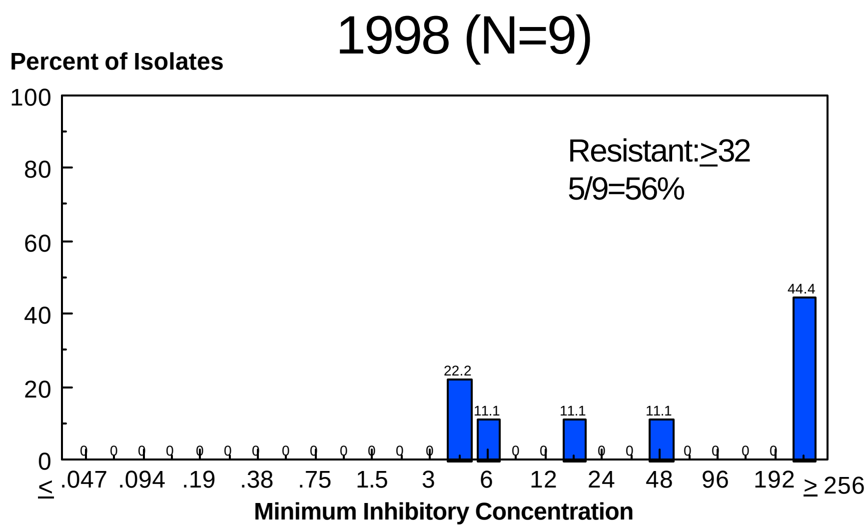
1999 (N=20)

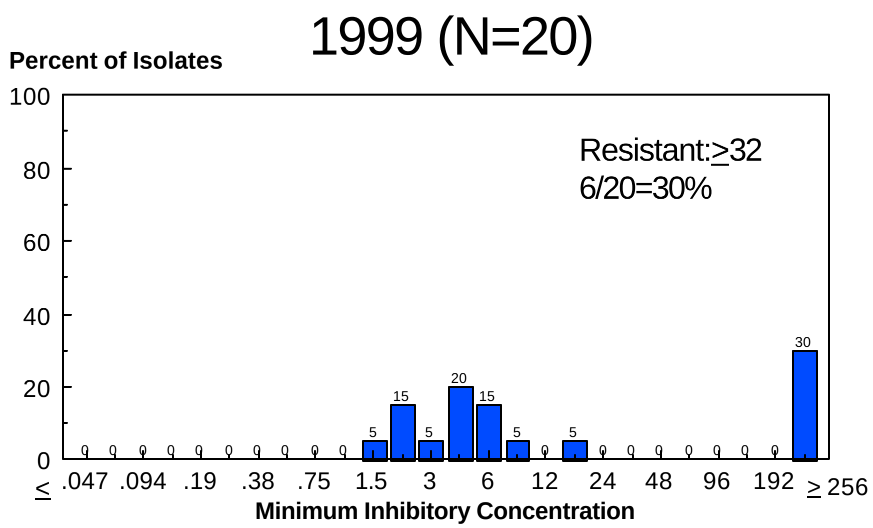


National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 19g. MICs for Nalidixic Acid among *Campylobacter coli* isolates, 1997 - 1999







National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 19h. MICs for Tetracycline among *Campylobacter coli* isolates, 1997 - 1999