Table of Contents

Graphs

NARMS Working Group, 2001

Centers for Disease Control and Prevention

Alicia Anderson, Frederick J. Angulo, Nicole Baker, Tim Barrett, Richard Bishop, Alison Drake, Kathryn Gay, Patricia M. Griffin, Kevin Joyce, Katie Lewis, Ewelina Lyszkowicz, Jennifer M. Nelson, Michael Omondi, Felicia Hardnett, Shannon Rossiter, Jennifer E. Stevenson, Robert V. Tauxe, Casey Theriot, Joy Wells, David Wheeler, Jean Whichard, Jennifer Wright, Foodborne and Diarrheal Diseases Branch, Division of Bacterial and Mycotic Diseases, National Center for Infectious Diseases

US Food and Drug Administration

Marcia Headrick and Linda Tollefson, Center for Veterinary Medicine

Participating State and Local Health Departments

California Department of Health Services
Sharon Abbott, Paul Kimsey, Sue Shallow, Duc Vugia, Jim Ware

Colorado Department of Public Health and Environment
Mike Rau, David Butcher, Carol Hoff, Richard Hoffman, Joyce Tomkosky, JB Penner

Connecticut Department of Public Health
Bob Howard, Don Mayo, Terry Rabatsky-Ehr

Florida Department of Health
Jody Baldy, Sonia Etheridge, Ronald Baker, Steven Wiersma

Georgia Division of Public Health
Marsha Ray, Mahin Park, Suzanne Segler, Elizabeth Franko, Stepy Thomas

Kansas Department of Health and Environment
Robert Flahart, June Sexton, Gail Hansen, Kristine Brunton, Carissa Pursell

Los Angeles County Department of Health Services
Joan Sturgeon, Mary Dorado, Deborah Brown, Laurene Mascola, Sheena Chu

Massachusetts Department of Public Health
Joseph Peppe, Alfred DeMaria, John Fontana, Robert Goldbaum, Tracy Stiles

Maryland Department of Health and Mental Hygiene and University of Maryland School of Medicine, Department of Epidemiology and Preventive Medicine
Glenn Morris, Marguerite Hawkins, Sonya Seccurro, Charmaine Gregg, David Torpey, Jonigene Ruark

Minnesota Department of Health
Fe Leano, Billie Juni, Charlott Taylor, Kirk Smith, Kim Moore, Sara Stenzel, John Besser

New Jersey Department of Health
Keith Pilot, Sylvia Matiuck, John Brook

New York City Department of Health
Alice Agasan, Mel Backer, Marci Layton, Vasudha Reddy

New York State Department of Health
Tim Root, Shelley Zansky, Amy Davignon, Dale Morse

Oregon Department of Human Resources
Steve Mauvais, Maureen Cassidy, Teresa McGivern, Beletsachew Shiferaw, Paul Cieslak

Tennessee Department of Health
Henrietta Hardin, Cynthia Graves, Jeanette Dill

Washington Department of Health
Donna Green, Craig Columbel, Romesh Gautom, Jennifer Breezee, Mike McDowell

West Virginia Department of Health and Human Resources
Doug McElfresh, Loretta Haddy, Connie Smith, Christi Clark

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Materials Available On-Line

All CDC NARMS Annual Reports are posted on the CDC NARMS Website. The address is www.cdc.gov/narms

Salmonella Annual Summaries are posted on the PHLIS website. The address is www.cdc.gov/ncidod/dbmd/phlisdata/salmonella.htm

Shigella Annual Summaries are also posted on the PHLIS website. The address is www.cdc.gov/ncidod/dbmd/phlisdata/shigella.htm

Information on animal isolates in NARMS is available on the USDA-ARS website at: http://www.ars-grin.gov/ars/SoAtlantic/Athens/arru/narms.html

General information about the NARMS surveillance program is posted on the FDA Center for Veterinary Medicine website at:
http://www.fda.gov/cvm/index/narms/narms_pg.html

Part I

Narrative Report

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Human Isolates Final Report, 2001

Summary of 2001 Data

There were 17 health departments, representing approximately 109 million persons (40% of the United States population), participating in the National Antimicrobial Resistance Monitoring System (NARMS) for Enteric Bacteria in 2001. Antimicrobial resistance among *Campylobacter* isolates was monitored in nine NARMS participating states; resistance among the other bacteria was monitored in all NARMS participating states.

The following key findings were observed in 2001:

<u>Multidrug Resistance</u>

Three multidrug-resistant strains accounted for 10% (142/1419) of non-Typhi *Salmonella* isolates tested by NARMS in 2001.

- In 2001, 7% (96/1419) of non-Typhi *Salmonella* isolates were *Salmonella* Typhimurium ACSSuT (resistant to at least ampicillin, chloramphenicol, streptomycin, sulfamethoxazole, and tetracycline), compared with 8% (103/1326) in 1996. These resistant isolates comprised 30% of *Salmonella* Typhimurium in 2001.

- In 2001, 1% (15/1419) of non-Typhi *Salmonella* isolates were *Salmonella* Typhimurium AKSSuT (resistant to at least ampicillin, kanamycin, streptomycin, sulfamethoxazole, and tetracycline), compared with 2% (27/1326) in 1996. These resistant isolates comprised 5% of *Salmonella* Typhimurium in 2001.

- In 2001, 2% (31/1419) of non-Typhi *Salmonella* isolates were *Salmonella* Newport MDR-AmpC (resistant to at least amoxicillin/clavulanic acid, ampicillin, cephalothin, ceftiofur, cefoxitin, chloramphenicol, streptomycin, sulfamethoxazole, tetracycline, and with decreased susceptibility [minimum inhibitory concentration (MIC) $\geq$ 16μg/ml] to ceftriaxone. In 1996, none were detected. These resistant isolates comprised 25% of Salmonella Newport in 2001.

Clinically Important Resistance

Fluoroquinolones (e.g., ciprofloxacin) and third generation cephalosporins (e.g., ceftriaxone) are commonly used antimicrobial agents for the treatment of severe *Campylobacter* and *Salmonella* infections, including *Salmonella* serotype Typhi. Nalidixic acid is an elementary quinolone; resistance to nalidixic acid correlates with decreased susceptibility to ciprofloxacin. An important proportion of isolates tested by NARMS in 2001 demonstrated resistance or decreased susceptibility to these clinically important antimicrobials.

- In 2001, 19% (75/384) of *Campylobacter* isolates were resistant to ciprofloxacin, compared with 13% (28/217) in 1997.

- In 2001, 1% (15/1419) of non-Typhi *Salmonella* isolates had decreased susceptibility (MIC $\geq$ 0.25μg/ml) to ciprofloxacin and 0.2% (3/1419) were resistant to ciprofloxacin. In 1996, 0.4% (5/1326) of non-Typhi *Salmonella* isolates had decreased susceptibility to ciprofloxacin and none were resistant.

- In 2001, 3% (48/1419) of non-Typhi *Salmonella* isolates had decreased susceptibility (MIC $\geq$ 16μg/ml) to ceftriaxone and 2% (34/1419) were resistant to ceftriaxone. In 1996, 0.1% (1/1326) had decreased susceptibility and 0.1% (1/1326) were resistant.

- In 2001, 18% (35/197) of *Salmonella* Typhi isolates were resistant to ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole, compared with 12% (20/166) in 1999.

- In 2001, 30% (59/197) of *Salmonella* Typhi isolates were nalidixic acid-resistant, compared with 23% (41/177) in 2000 and 19% (31/166) in 1999.

Surveillance and Laboratory Testing Methods

NARMS is a collaboration between the Centers for Disease Control and Prevention (CDC) National Center for Infectious Diseases, the U.S. Food and Drug Administration (FDA) Center for Veterinary Medicine, the U.S. Department of Agriculture (USDA) Food Safety and Inspection Service, the USDA Agricultural Research Service, and 17 state and local health departments. CDC monitors antimicrobial resistance in enteric bacteria isolated from humans, USDA monitors antimicrobial resistance in enteric bacteria isolated from animals, and FDA monitors antimicrobial resistance in enteric bacteria isolated from meats.

Many NARMS activities are conducted within the framework of CDC's Emerging Infections Program's Epidemiology and Laboratory Capacity Program and the Foodborne Disease Active Surveillance Network (FoodNet). The primary purpose of NARMS is to monitor antimicrobial resistance among foodborne enteric bacteria isolated from humans. NARMS data are also used to provide platforms for additional studies including field investigations and molecular characterization of resistance determinants, and to guide efforts to mitigate antimicrobial resistance.

NARMS began in 1996 to monitor prospectively the antimicrobial resistance of human non-Typhi *Salmonella* and *Escherichia coli* O157 isolates. Testing of human *Campylobacter* isolates was added in 1997, and testing of human *Salmonella* Typhi and *Shigella* isolates was added in 1999. Before NARMS was established, CDC monitored antimicrobial resistance in *Salmonella, Shigella*, and *Campylobacter* using periodic surveys of isolates from a panel of sentinel counties. In 2001, there were 17 NARMS health department participants (California, Colorado, Connecticut, Florida, Georgia, Kansas, Los Angeles County, Massachusetts, Maryland, Minnesota, New Jersey, New York City, New York State, Oregon, Tennessee, Washington, and West Virginia), representing approximately 109 million persons (40% of the United States population) [Table 1]. In 2001, the nine NARMS participating state health departments (California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New York, Oregon, and Tennessee) that also participate in FoodNet monitored antimicrobial resistance among human *Campylobacter* isolates [Table 1].

In 2001, NARMS participating public health laboratories systematically 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. Non-Typhi *Salmonella* refers to all *Salmonella* serotypes except serotype Typhi. At CDC, *Salmonella*, *Shigella*, and *E. coli* O157 isolates are tested with a semi-automated system (Sensititre®, Trek Diagnostics, Westlake, OH) to determine the partial range MIC for 17 antimicrobial agents: amikacin, ampicillin, amoxicillin-clavulanic acid, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, and trimethoprim-sulfamethoxazole [Table 2]. Isolates meeting screening criteria for possible ceftriaxone resistance (ceftiofur MIC $\geq$ 4 μg/ml and / or ceftriaxone MIC $\geq$ 2 μg/ml, via Sensititre®), were tested for ceftriaxone susceptibility with by-hand broth microdilution. Before 1999, isolates meeting the screening criteria were additionally tested to confirm ceftriaxone susceptibility results with the E-test system (AB BIODISK, Solna, Sweden). In this report, with the exception of the Sensititre® MIC data reported in Figures 2g, 12g, 15g, 16g, and 18g, ceftriaxone results are based upon the confirmatory testing (by-hand broth microdilution or E-test system).

The nine state public health departments that participate in FoodNet forwarded *Campylobacter* isolates to CDC for susceptibility testing. Selection of *Campylobacter* isolates to submit to NARMS was conducted by either of two ways. In Georgia, Maryland, Minnesota, New York, and Tennessee, one isolate a week was selected (usually the first isolate received each week is selected, but otherwise isolates were randomly selected) from the collection of isolates sent to the state health department laboratory from almost all clinical laboratories in a geographical area (metro Atlanta area in Georgia, statewide in Maryland and Minnesota, metro Albany and Rochester areas in New York, and Gallatin, Knoxville, and Nashville areas in Tennessee). In California, Colorado, Connecticut, and Oregon, the first isolate isolated each week was selected at one sentinel clinical laboratory. Sentinel clinical laboratories followed routine isolation practices for *Campylobacter*. At CDC, isolates were confirmed as *Campylobacter* by dark field microscopy and oxidase test. Identification to species level was performed using the hippurate hydrolysis test. Hippurate-positive isolates were identified as *C. jejuni*. Hippurate-negative isolates were identified as *C. jejuni* by the hippuricase gene-based PCR assay or as *C. coli* based on polymerase chain reaction (PCR) test for the coli-specific *ceuE* gene. Isolates that were determined not to be *C. jejuni* or *C. coli* were referred to the National *Campylobacter* Reference Laboratory at CDC for identification using genotypic and phenotypic methods. The E-test system was used to determine the MICs for 8 antimicrobial agents: azithromycin, chloramphenicol, ciprofloxacin, clindamycin, erythromycin, gentamicin, nalidixic acid, and tetracycline [Table 2]. No more than 53 *Campylobacter* isolates, per state in 2001, were included in NARMS analyses; if more than 53 isolates were received, only the first 4 or 5 isolates received each month, depending on the number of Mondays in the month, were included.

For all pathogens in this report, MIC results were dichotomized: isolates with intermediate susceptibility were categorized as susceptible. Analysis was restricted to one isolate (per pathogen) per patient. When established, National Committee for Clinical Laboratory Standards (NCCLS) interpretive criteria were used; apramycin resistance was defined as MIC $\geq$ 64 μg/ml and ceftiofur resistance was defined as MIC $\geq$ 8 μg/ml [Table 2]. Multidrug resistance was defined as resistance to two or more antimicrobial agents.

A review of NARMS *Campylobacter* data showed a higher than expected proportion of isolates that were resistant to erythromycin and gentamicin in 1997. Therefore, all NARMS *Campylobacter* isolates with any resistance in 1997 were re-tested. This report reflects these more recent test results. Furthermore, it was observed that more than 53 *Campylobacter* isolates were submitted to CDC NARMS from Georgia (N=81) and Minnesota (N=59) in 1998, and New York (N=54) in 1999. The additional isolates, from those states for those years, were excluded from analyses until no more than the maximum number of isolates (N=53) per year, in each state, were included in NARMS. This report also reflects these changes.

Logistic regression analyses were performed to assess the change in antimicrobial resistance among *Salmonella* isolates tested in NARMS in 1996 and 2001. These included 1) ceftriaxone, ciprofloxacin, and nalidixic acid resistance among non-Typhi *Salmonella*, 2) nalidixic acid resistance among *Salmonella* Typhi, 3) multidrug resistance among *Salmonella* serotype Newport, and 4) multidrug resistance among *Salmonella* serotype Typhimurium. Multivariate logistic regression analyses were performed to assess the change in ciprofloxacin resistance among *Campylobacter spp*. and *Campylobacter jejuni* isolates tested in NARMS in 1997 and 2001. All final multivariate models took into account both population variation and site variation.

When describing results from several years, multidrug resistance for *Salmonella*, *E. coli* O157, and *Shigella* isolates was limited to the 15 agents tested in all years from 1996 to 2001 (amoxicillin-clavulanic acid, ampicillin, apramycin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole). Similarly, when describing multidrug resistance for several years for *Campylobacter* isolates, multidrug resistance was limited to the 6 agents tested in all years from 1997 to 2001 (chloramphenicol, ciprofloxacin, clindamycin, erythromycin, nalidixic acid, tetracycline).

Results

Non-Typhi *Salmonella*

Results for 2001

A total of 1469 non-Typhi *Salmonella* isolates were received at CDC in 2001 [Figure 1]; of these isolates, 1462 (99%) were viable and tested for antimicrobial susceptibility. Of these 1462 isolates, 43 isolates were eliminated from analysis because they were duplicate submissions (30 isolates) or the county of residence was outside the catchment area (13 isolates), leaving 1419 isolates tested for susceptibility to 17 antimicrobial agents for analysis.

Figures 2a-2q provide Sensititre® MIC results for the non-Typhi *Salmonella* isolates for each of the 17 antimicrobial agents tested in 2001. Thirty-four (57%) of the 60 non-Typhi *Salmonella* isolates meeting the screening criteria for confirmatory testing were resistant to ceftriaxone on confirmatory testing [Table 3]. Among the 1419 non-Typhi *Salmonella* isolates, 394 (28%) were resistant to one or more antimicrobial agents, 315 (22%) were resistant to two or more agents, 176 (12%) were resistant to five or more agents, and 40 (3%) were resistant to eight or more agents [Figure 3]. Of the 176 isolates resistant to five or more agents, 114 (65%) were serotype Typhimurium. Of the 40 isolates resistant to eight or more agents, 31 (77%) were serotype Newport. The antimicrobial agents to which the 1419 *Salmonella* demonstrated the highest prevalence of resistance were tetracycline, sulfamethoxazole, streptomycin, and ampicillin: 280 (20%) were resistant to tetracycline, 251 (18%) were resistant to sulfamethoxazole, 241 (17%) were resistant to streptomycin, and 247 (17%) were resistant to ampicillin [Table 4, Figure 4]. Tables 5a through 5e show the correlation of resistance among non-Typhi *Salmonella*, *Salmonella* Typhi, *Shigella*, *E. coli* O157, and *Campylobacter* isolates, respectively. These correlation tables are useful to determine the co-resistance between and to antimicrobial agents. For example, among the 34 non-Typhi *Salmonella* isolates resistant to ceftriaxone, 34 (100%) were additionally resistant to amoxicillin-clavulanic acid, ampicillin, cefoxitin, ceftiofur, and cephalothin, 32 (94%) were resistant to streptomycin, 31 (91%) were resistant to sulfamethoxazole and tetracycline, and 30 (88%) were resistant to chloramphenicol.

Among 1419 *Salmonella* isolates tested, 1399 (99%) could be serotyped. Among the 1399 serotyped isolates, 325 (23%) were serotype Typhimurium (includes serotype Typhimurium var. Copenhagen), 282 (20%) were serotype Enteritidis, 124 (9%) were serotype Newport, 100 (7%) were serotype Heidelberg, and 51 (4%) were serotype Javiana; the 16 most common serotypes accounted for 80% (1125/1399) of isolates that were serotyped [Table 6]. The serotypes with the highest proportion of isolates that were pansusceptible (among the 16 most common serotypes) were Javiana (100%), Oranienburg (97%), and Thompson (96%); the serotypes with the highest proportion of isolates that were resistant to one or more antimicrobial agents were Agona (53%), Typhimurium (51%), and Stanley (47%) [Table 7, Table 8]. Figures 5a-5p provide susceptibility results for each of the antimicrobial agents tested, for the 16 most common serotypes. Among the 325 *S.* Typhimurium isolates, 165 (51%) were resistant to one or more antimicrobial agents and 156 (48%) were multidrug resistant. Among the 282 *S.* Enteritidis isolates, 40 (14%) were resistant to one or more antimicrobial agents and 16 (6%) were multidrug resistant [Table 8]. Among the 124 *S*. Newport isolates, 43 (35%) were resistant to one or more antimicrobial agents and 39 (31%) were multidrug resistant; 79% (31/39) of the multidrug resistant *S.* Newport were resistant to 8 or more antimicrobials. The serotypes with the highest proportion of multidrug resistance were Typhimurium (48%), Stanley (47%), and Newport (31%). Tables 9a-9i provide data on multidrug resistance among the most common serotypes in each site.

Figure 6 shows the number of *S.* Typhimurium isolates submitted by site, by year. In recent years, two multidrug-resistant phenotypes of *S.* Typhimurium have been frequently identified. The most prominent strain is resistant to at least ampicillin, chloramphenicol, streptomycin, sulfamethoxazole, and tetracycline (ACSSuT), a phenotype commonly associated with Definitive Type 104 (DT104) [Table 10]. Among 325 *S.* Typhimurium isolates tested in 2001, 96 (29%) had at least the ACSSuT resistance pattern [Figure 7]. Of the 96 *S.* Typhimurium isolates with at least the ACSSuT resistance pattern, 13 (13%) were also resistant to amoxicillin-clavulanic acid, 4 (4%) to cephalothin, 4 (4%) to cefoxitin, 4 (4%) to ceftiofur, 4 (4%) to kanamycin, 3 (3%) to trimethoprim-sulfamethoxazole, 2 (2%) to gentamicin, 1 (1%) to ceftriaxone, 1 (1%) to ciprofloxacin, and 1 (1%) to nalidixic acid [Table 11]. A second multidrug resistant strain, resistant to at least ampicillin, kanamycin, streptomycin, sulfamethoxazole, and tetracycline (AKSSuT), was also common among *S*. Typhimurium [Table 10]. Among 325 *S.* Typhimurium isolates tested in 2001, 15 (5%) had at least the AKSSuT resistance pattern [Figure 8]. Of the 15 *S.* Typhimurium isolates with at least the AKSSuT resistance pattern, 4 (27%) were also resistant to chloramphenicol, 1 (7%) to amoxicillin-clavulanic acid, 1 (7%) to cefoxitin, 1 (7%) to ceftiofur, 1 (7%) to ceftriaxone, 1 (7%) to cephalothin, 1 (7%) to gentamicin, and 1 (7%) to trimethoprim-sulfamethoxazole [Table 11].

Figure 9 shows the number of *S.* Newport isolates submitted by site, by year. The most common multidrug-resistant phenotype among *S.* Newport was resistance to amoxicillin/clavulanic acid, ampicillin, cephalothin, cefoxitin, ceftiofur, chloramphenicol, streptomycin, sulfamethoxazole, tetracycline, and decreased susceptibility to ceftriaxone (MDR-AmpC). Among the 124 *S.* Newport isolates tested in 2001, 31 (25%) had at least the MDR-AmpC resistance pattern [Table 12, Figure 10]. Of the 31 *S.* Newport with at least the MDR-AmpC resistance pattern, 29 (93%) were also resistant to ceftriaxone, 6 (19%) to kanamycin, 2 (6%) to gentamicin, and 1 (3%) to trimethoprim-sulfamethoxazole [Table 13].

The three most common multidrug resistant phenotypes in 2001 were *S*. Typhimurium with at least the ACSSuT resistance pattern, *S*. Newport with at least the MDR-AmpC resistance pattern, and *S*. Typhimurium with at least the AKSSuT resistance pattern [Table 14]. These multidrug resistant phenotypes, respectively, accounted for 7%, 2% and 1% of all non-Typhi *Salmonella* isolates and 30%, 10%, and 5% of the multidrug resistant non-Typhi *Salmonella* isolates in 2001. Table 15 describes the clinical source of all non-Typhi *Salmonella* isolates tested in 2001. Of the 1419 non-Typhi *Salmonella* isolates, 1218 (86%) were collected from stool specimens, 71 (5%) were from blood specimens, 87 (6%) were from other sources, and 43 (3%) were from an unknown source.

Table 16 shows the proportion of non-Typhi *Salmonella* isolates that showed decreased susceptibility or resistance to ciprofloxacin or ceftriaxone. Table 17 shows the proportion of non-Typhi *Salmonella* isolates with a decreased susceptibility to ciprofloxacin by site. Fifteen non-Typhi *Salmonella* isolates (1%) had a decreased susceptibility to ciprofloxacin; of which, 3 (0.2%) were resistant to ciprofloxacin. Table 18 shows the proportion of non-Typhi *Salmonella* isolates with a decreased susceptibility to ceftriaxone by site. Forty-eight non-Typhi *Salmonella* isolates (3%) had a decreased susceptibility to ceftriaxone; of which 34 (71%) were resistant to ceftriaxone.

Changes in Antimicrobial Resistance since 1996

In 1996, 34% (103/306) of *S.* Typhimurium isolates tested had at least the ACSSuT resistance pattern [Table 19]. This proportion increased to 35% (115/326) in 1997; after which, it decreased to 32% (120/377) in 1998, 28% in both 1999 (102/362) and 2000 (84/303), and 29% (96/325) in 2001 [Figure 7]. Although the proportion of *S*. Typhimurium isolates with at least the ACSSuT resistance pattern decreased, there is no significant difference in the proportion of *S*. Typhimurium isolates with at least the ACSSuT resistance pattern in 1996 and 2001 (95% CI [0.5, 1.3]). A similar pattern was seen among *S.* Typhimurium isolates with at least the AKSSuT resistance pattern. In 1996, the prevalence of AKSSuT among *S.* Typhimurium was 9% (27/306). This proportion rose to 13% (41/326) in 1997. In subsequent years, there was a decline in prevalence of AKSSuT among *S.* Typhimurium isolates: 12% (47/377) in 1998, 11% (39/362) in 1999, 9% (28/303) in 2000 and 5% (15/325) in 2001 [Figure 8]. Although the proportion of *S*. Typhimurium isolates with at least the AKSSuT resistance pattern decreased, there is no significant difference in the proportion of *S*. Typhimurium isolates with at least the AKSSuT resistance pattern in 1996 and 2001 (95% CI [0.2, 1.1]).

In 1996 and 1997, none of the *S.* Newport isolates had at least the MDR-AmpC resistance pattern. This proportion increased to 1% (1/77) in 1998, 17% (17/98) in 1999, 22% (27/124) in 2000, and 25% (31/124) in 2001 [Figure 10]. Using an exact logistic regression model, *S*. Newport isolates in 2001 were more likely to have at least the MDR-AmpC resistance pattern ($p<.01$) than isolates in 1996.

The percentage of non-Typhi *Salmonella* isolates with decreased susceptibility to ciprofloxacin increased from 0.4% (5/1326) in 1996 to 1% (15/1419) in 2001; the percentage resistant to ciprofloxacin increased from 0% in 1996 to 0.2% in 2001. Using a logistic regression model, non-Typhi *Salmonella* isolates in 2001 were 2.8 times more likely to have a decreased susceptibility to ciprofloxacin (95% CI [1.0, 7.8]) than isolates in 1996. Additionally, the percentage of *Salmonella* isolates with decreased susceptibility to ceftriaxone increased from 0.1% (1/1326) in 1996 to 3% (48/1419) in 2001; the percentage resistant to ceftriaxone increased from 0.1% in 1996 to 2% in 2001 [Table 19]. Using a logistic regression model, non-Typhi *Salmonella* isolates were 47.7 times more likely to have a decreased susceptibility to ceftriaxone (95% CI [4.6, 492.9]) than isolates in 1996.

Limitations

The major limitations in NARMS non-Typhi *Salmonella* surveillance are the sampling scheme and the limited geographic area under surveillance. It is important to evaluate whether these limitations might be associated with an increased or decreased likelihood of antimicrobial resistance among non-Typhi *Salmonella* in NARMS.

In 2001, NARMS participating public health laboratories systematically selected every tenth non-Typhi *Salmonella* isolate received at their laboratory, and forwarded those isolates to CDC for antimicrobial susceptibility testing. NARMS participating public health laboratories are instructed to maintain a running count of non-Typhi *Salmonella* isolates received and to systematically select every tenth isolate for NARMS; when the isolates are selected, the antimicrobial resistance pattern of the isolates is not known. It is therefore unlikely that the antimicrobial resistance pattern of an isolate would influence submission of the isolate to NARMS.

There were 17 NARMS public health department participants in NARMS non-Typhi *Salmonella* surveillance in 2001, representing approximately 109 million persons or 40% of the United States population. Because NARMS 2001 non-Typhi *Salmonella* surveillance was not nationwide, generalization to the United States population should be done with caution due to potential regional differences in the prevalence of antimicrobial resistance among non-Typhi *Salmonella*. However, analyses of changes in the prevalence of resistance from 1996 to 2001 are not subject to the above limitation within the population under surveillance.

***Salmonella* Typhi**

Results in 2001

A total of 219 *S.* Typhi isolates were received at CDC in 2001 [Figure 1]; 211 (96%) were viable upon receipt and tested for antimicrobial susceptibility. Of these 211 isolates, 14 isolates were eliminated from analysis because they were duplicate submissions (12 isolates) or the county of residence was outside the catchment area (2 isolates), leaving 197 isolates for analysis. Among the 197 *S.* Typhi isolates, 81 (41%) were resistant to one or more antimicrobial agents and 45 (23%) were resistant to two or more agents [Table 34]. The most common resistances among the 197 *S.* Typhi isolates were to nalidixic acid (30%), chloramphenicol (21%), tetracycline (21%), trimethoprim-sulfamethoxazole (21%), ampicillin (20%), and streptomycin (20%) [Table 4, Figure 11]. Figures 12a-12q provide data on *Salmonella* Typhi MICs by antimicrobial agent. None of the *S.* Typhi isolates tested were resistant to amoxicillin-clavulanic acid, ceftriaxone, ciprofloxacin, or imipenem.

Changes in Antimicrobial Resistance in NARMS since 1999

In 1999, 12% (20/166) of *S.* Typhi isolates tested were resistant to at least ampicillin, chloramphenicol, and sulfamethoxazole-trimethoprim (ACSuTm). This proportion decreased to 9% (16/177) in 2000; after which, it rose to 18% (35/197) in 2001. The percentage of *S*. Typhi isolates resistant to nalidixic acid increased from 19% (31/166) in 1999 to 30% (59/197) in 2001. Using a logistic regression model, *S*. Typhi isolates in 2001 were 1.9 times more likely to be resistant to nalidixic acid (95% CI [1.1, 3.1]) than isolates in 1999.

Limitations

One limitation is evident in NARMS 2001 *Salmonella* Typhi surveillance, the limited geographic area under surveillance.

There were 17 NARMS public health department participants in NARMS *Salmonella* Typhi surveillance in 2001, representing approximately 109 million persons or 40% of the United States population. NARMS participating public health laboratories forwarded every *Salmonella* Typhi isolate received at their laboratory to CDC for antimicrobial susceptibility testing. Because NARMS 2001 *Salmonella* Typhi surveillance was not nationwide, generalization to the United States population should be done with caution due to potential regional differences in the prevalence of antimicrobial resistance among *Salmonella* Typhi.

Shigella

Results of NARMS in 2001

A total of 360 *Shigella* isolates were received at CDC in 2001 [Figure 1]; 351 (97%) were viable upon receipt and tested for antimicrobial susceptibility. Seven isolates were eliminated from analysis because they were duplicate submissions (4 isolates) or the county of residence was outside the catchment area (3 isolates), leaving 344 isolates for analysis. Of the 344 isolates analyzed, 239 (69%) were *S. sonnei*, 91 (26%) were *S. flexneri*, 5 (1%) were *S. boydii*, 3 (1%) were *S. dysenteriae*, and 6 (2%) were provisional *Shigella* species [Table 23]. Among the 344 *Shigella* isolates, 327 (95%) were resistant to one or more antimicrobial agents and 244 (71%) were multidrug resistant [Table 34]. The most common resistances among the 344 *Shigella* isolates were to ampicillin (80%), tetracycline (59%), sulfamethoxazole (56%), streptomycin (53%), and trimethoprim-sulfamethoxazole (47%) [Table 25, Figure 13]. The 239 *Shigella sonnei* isolates were most frequently resistant to ampicillin (83%), streptomycin (54%), sulfamethoxazole (54%), and trimethoprim-sulfamethoxazole (51%) [Figure 14a]. The most common resistances among the 91 *Shigella flexneri* isolates were to tetracycline (94%), chloramphenicol (75%), and ampicillin (72%) [Figure 14b]. Figures 15a-15q and 16a-16q provide data on *Shigella sonnei* and *Shigella flexneri* MICs by antimicrobial agent. None of the *Shigella* isolates tested were resistant to amikacin, apramycin, ceftiofur, ceftriaxone, gentamicin, or imipenem. One (0.3%) *Shigella* isolate, a *Shigella flexneri* isolate, was resistant to ciprofloxacin and none had a decreased susceptibility to ceftriaxone.

Changes in Antimicrobial Resistance in NARMS since 1999

In 1999, 78% of *Shigella* isolates tested were resistant to ampicillin; this percentage increased to 79% in 2000 and 80% in 2001. From 1999 to 2001 there was a decrease in the percentage of *Shigella* isolates with the ACSuTm (ampicillin, chloramphenicol, sulfamethoxazole-trimethoprim) resistance pattern, representing 10% (37/375), 7% (31/451), and 7% (24/344) of isolates in 1999, 2000, and 2001, respectively. No *Shigella* isolates tested in 1999 and 2000 were resistant to ciprofloxacin; one isolate was resistant to ciprofloxacin in 2001.

Limitations

Two limitations are evident in NARMS *Shigella* surveillance, the sampling scheme and the limited geographic area under surveillance. It is important to evaluate whether these limitations might be associated with an increased or decreased likelihood of antimicrobial resistance among *Shigella* in NARMS.

In 2001, NARMS participating public health laboratories systematically selected every tenth *Shigella* isolate received at their laboratory, and forwarded those isolates to CDC for antimicrobial susceptibility testing. NARMS participating public health laboratories are instructed to maintain a running count of *Shigella* isolates received and to systematically select every tenth isolate for NARMS; when the isolates are selected, the antimicrobial resistance pattern of the isolates is not known. It is therefore unlikely that the antimicrobial resistance pattern of an isolate would influence submission of the isolate to NARMS.

There were 17 NARMS public health department participants in NARMS *Shigella* surveillance in 2001, representing approximately 109 million persons or 40% of the United States population. Because NARMS 2001 *Shigella* surveillance was not nationwide, generalization to the United States population should be done with caution due to potential regional differences in the prevalence of antimicrobial resistance among *Shigella*.

***E. coli* O157**

Results in 2001

A total of 294 *E. coli* O157 isolates were received at CDC in 2001 [Figure 1]; 284 (97%) were viable and tested for antimicrobial susceptibility. Of these 284 isolates, 7 isolates were eliminated from analysis because they were duplicate submissions (4 isolates) or the county of residence was outside the catchment area (3 isolates), leaving 277 isolates for analysis. Among the 277 *E. coli* O157 isolates, 24 (9%) were resistant to one or more antimicrobial agents and 15 (5%) were multidrug resistant [Table 34]. The most common resistances among the 277 *E. coli* O157 isolates were to sulfamethoxazole (5%), tetracycline (5%), ampicillin (2%), and streptomycin (2%) [Table 4, Figure 17]. Figures 18a-18q provide data on *E. coli* O157 MICs by antimicrobial agent. None of the *E. coli* O157 isolates tested were resistant to amikacin, apramycin, ceftriaxone, ciprofloxacin, imipenem or kanamycin. Two (1%) had a decreased susceptibility to ceftriaxone and 2 (1%) had a decreased susceptibility to ciprofloxacin.

Changes in Antimicrobial Resistance in NARMS since 1996

No *E. coli* O157 isolates were nalidixic acid-resistant from 1996 to 1998. The number of isolates resistant to nalidixic acid was 2 (1%) isolates in 1999, 2 (0.5%) in 2000, and 3 (1%) in 2001.

Limitations

Two limitations are evident in NARMS *E. coli* O157 surveillance, the sampling scheme and the limited geographic area under surveillance. It is important to evaluate whether these limitations might be associated with an increased or decreased likelihood of antimicrobial resistance among *E. coli* O157 in NARMS.

In 2001, NARMS participating public health laboratories systematically selected every fifth *E. coli* O157 isolate received at their laboratory, and forwarded those isolates to CDC for antimicrobial susceptibility testing. NARMS participating public health laboratories are instructed to maintain a running count of *E. coli* O157 isolates received and to systematically select every fifth isolate for NARMS; when the isolates are selected, the antimicrobial resistance pattern of the isolates is not known. It is therefore unlikely that the antimicrobial resistance pattern of an isolate would influence submission of the isolate to NARMS.

There were 17 NARMS health department participants in NARMS *E. coli* O157 surveillance in 2001, representing approximately 109 million persons or 40% of the United States population. Because NARMS 2001 *E. coli* O157 surveillance was not nationwide, generalization to the United States population should be done with caution due to potential regional differences in the prevalence of antimicrobial resistance among *E. coli*.

Campylobacter

Results in 2001

A total of 497 presumptive *Campylobacter* isolates were received at CDC in 2001; of these isolates, 425 (85%) were viable upon receipt. Of these 425 isolates, 41 isolates were eliminated from analysis because they were duplicate submissions (22 isolates) or were not *Campylobacter* (19 isolates), leaving 384 isolates tested for antimicrobial susceptibility to 8 antimicrobial agents for analysis. Of the 384 isolates tested, 365 (95%) were *C. jejuni*, 17 (4%) were *C. coli*, 1 (0.3%) was *C. fetus*, and 1 (0.3%) was “other” species [Table 28].

Among the 384 *Campylobacter* isolates tested, 193 (50%) were resistant to one or more antimicrobial agents and 81 (21%) were resistant to two or more agents [Table 34]. The most common resistances among the 384 *Campylobacter* isolates were to tetracycline (41%), nalidixic acid (20%), ciprofloxacin (19%), and erythromycin (2%) [Table 31, Figure 19]. None of the *Campylobacter* isolates tested were resistant to chloramphenicol or gentamicin.

Among the 365 *Campylobacter jejuni* isolates, 181 (50%) were resistant to one or more antimicrobial agents and 73 (20%) were resistant to two or more agents [Table 34]. The most common resistances among the 365 *Campylobacter jejuni* isolates were to tetracycline (40%) followed by nalidixic acid (19%), ciprofloxacin (18%), and erythromycin (2%) [Table 32, Figure 20a]. Figures 21a-21h provide data on *C. jejuni* MICs by antimicrobial agent. The proportion of ciprofloxacin-resistance *C. jejuni* varied by site: Connecticut 12/43 (28%), Georgia 14/52 (27%), California 11/46 (24%), Maryland 7/36 (19%), Tennessee 5/31 (16%), Minnesota 7/47 (15%), New York 5/44 (11%), Colorado 4/40 (10%), and Oregon 2/26 (8%) [Table 30].

Among the 17 *Campylobacter coli* isolates, 11 (65%) were resistant to one or more antimicrobial agents and 8 (47%) were resistant to or more agents [Table 34]. The most common resistances among the 17 *Campylobacter coli* isolates were to tetracycline (59%), ciprofloxacin (47%), nalidixic acid (41%), and erythromycin (6%) [Table 33, Figure 20b]. Figures 22a-22h provide data on *C. coli* MICs by antimicrobial agent.

Changes in Antimicrobial Resistance in NARMS since 1997

The percentage of *Campylobacter* isolates resistant to ciprofloxacin was 13% (28/217) in 1997, 13% (42/311) in 1998, 18% (58/318) in 1999, 14% (46/324) in 2000, and 19% (75/384) in 2001. The percentage of *Campylobacter jejuni* isolates resistant to ciprofloxacin was 12% (26/209) in 1997, 14% (41/298) in 1998, 18% (52/294) in 1999, 14% (43/306) in 2000, and 18% (67/365) in 2001. The percentage of *Campylobacter coli* isolates resistant to ciprofloxacin was 33% (2/6) in 1997, 0% (0/8) in 1998, 30% (6/20) in 1999, 25% (3/12) in 2000, and 47% (8/17) in 2001. During the same time period, the percentage of *Campylobacter* isolates resistant to nalidixic acid increased from 14% (31/217) in 1997 to 20% (77/384) in 2001; the percentage of *Campylobacter jejuni* isolates resistant to nalidixic acid increased from 13% (28/209) in 1997 to 19% (69/365) in 2001; whereas, the percentage of *Campylobacter coli* isolates resistant to nalidixic acid decreased from 50% (3/6) in 1997 to 41% (7/17) in 2001.

In the multivariate logistic regression model, the proportion of *Campylobacter* isolates resistant to ciprofloxacin in 2001, controlling for site variation and age, was 2.4 times higher (95% CI [1.4, 4.0]) than in 1997. This increase was relatively consistent, with the proportion of ciprofloxacin-resistant *Campylobacter* increasing every year compared with the previous year, except in 2000. When restricting the multivariate logistic regression analysis to *Campylobacter jejuni* isolates only, the proportion of *C. jejuni* isolates was 2.1 times more likely (95% CI [1.2, 3.6]) to be resistant to ciprofloxacin in 2001 than in 1997. This increasing trend also was relatively consistent over the years.

Limitations

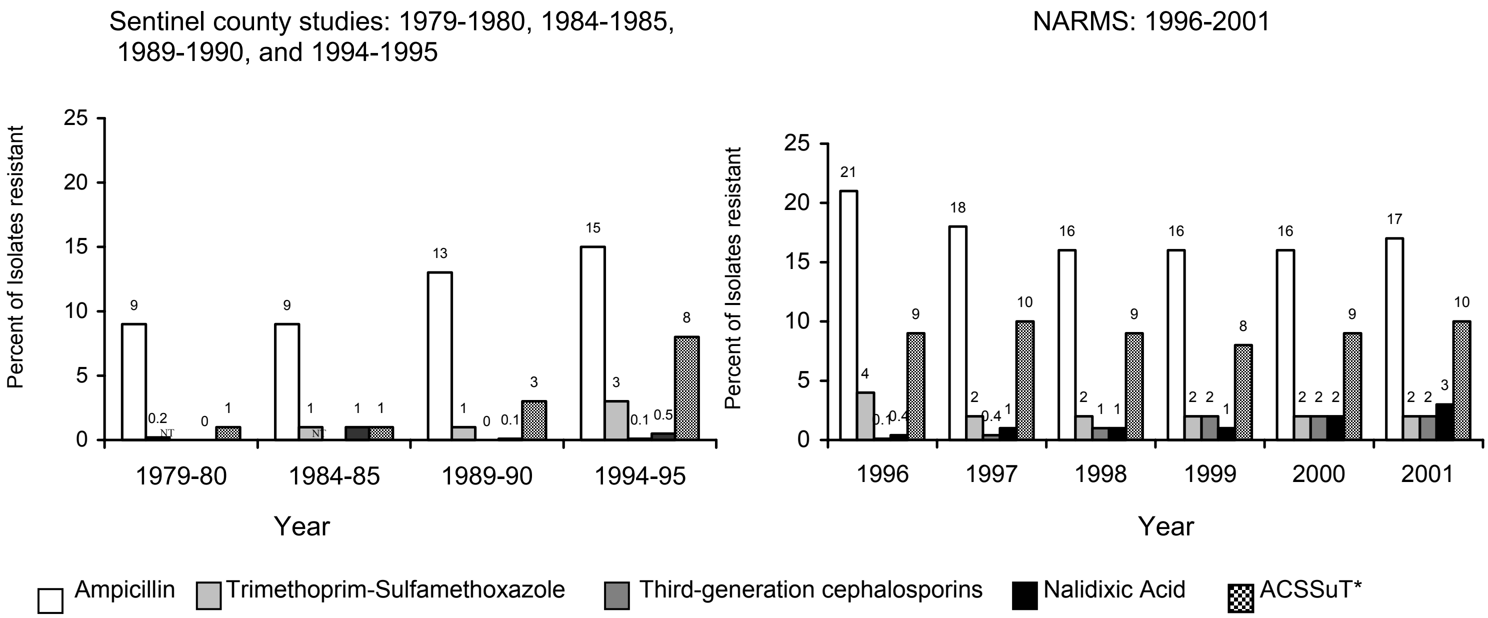
Three limitations are evident in NARMS 2001 *Campylobacter* surveillance, the use of sentinel clinical laboratories in some states, the sampling scheme, and the limited geographic area under surveillance.

In four states that participated in NARMS *Campylobacter* surveillance in 2001 (California, Colorado, Connecticut, and Oregon), *Campylobacter* isolates were submitted to NARMS from one sentinel clinical laboratory. In Georgia, Maryland, Minnesota, New York, and Tennessee, the *Campylobacter* isolates submitted to NARMS were selected (usually the first isolate received each week is selected, but otherwise isolates were randomly selected) from all *Campylobacter* isolates from most clinical laboratories within a specific geographical area (metro Atlanta area in Georgia, statewide in Maryland and Minnesota, the metro Albany and Rochester areas in New York, and the metro Gallatin, Knoxville, and Nashville areas in Tennessee). In California, Colorado, Connecticut, and Oregon, the sentinel clinical laboratory selected the first *Campylobacter* isolate isolated each week for submission to NARMS; if no isolate was isolated in a week, then no isolate was submitted from that laboratory. Since none of the sentinel clinical laboratories used an isolation procedure that was more or less likely to yield antimicrobial-resistant *Campylobacter* isolates than other clinical laboratories in their respective states, it is unlikely that the use of a sentinel clinical laboratory would be associated with an increased or decreased likelihood of antimicrobial resistance among *Campylobacter* isolates submitted to NARMS.

In 2001, the NARMS participating public health laboratory in Maryland, Minnesota, New York, and Tennessee, FoodNet personnel in Georgia, and sentinel clinical laboratories in all other FoodNet sites, selected one *Campylobacter* isolate each week and forwarded the isolate to CDC. When the isolates were selected, the antimicrobial resistance pattern of the isolates was not known. Therefore, it is unlikely that the antimicrobial resistance pattern of an isolate would influence submission of the isolate to NARMS. However, the one-a-week sampling scheme could result in over- or under-sampling of antimicrobial-resistant isolates if the prevalence of such resistance is not uniform throughout the year. The impact of the over- or under-sampling may be variable among states.

Campylobacter isolates were forwarded to CDC by nine FoodNet participating states in 2001, representing approximately 34 million persons or 12% of the United States population. Because NARMS 2001 *Campylobacter* surveillance was not nationwide, generalization to the United States population should be done with caution due to potential regional differences in the prevalence of antimicrobial resistance among *Campylobacter*. However, analyses of changes in the prevalence of resistance from 1997 to 2001 are not subject to the above limitation within the population under surveillance.

Summary of Long Term Changes in Antimicrobial Resistance in non-Typhi Salmonella Isolates, 1979-2001

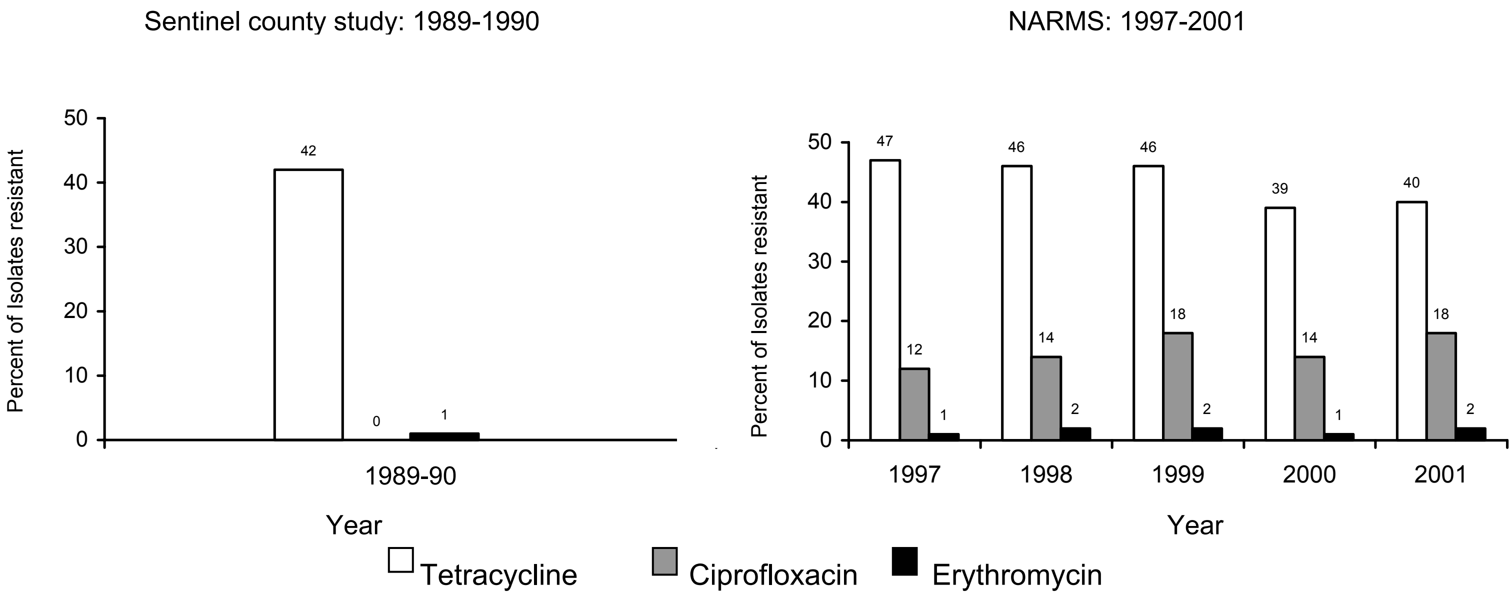


*ACSSuT = resistance to ampicillin, chloramphenicol, streptomycin, sulfamethoxazole, and tetracycline; NT=Not Tested

For non-Typhi *Salmonella*, sentinel county surveys were conducted in 1979-80, 1984-85, 1989-90, and 1994-95 (1,2,3,4). Isolates were tested at CDC by disk diffusion. The National Antimicrobial Resistance Monitoring System (NARMS) for Enteric Bacteria began testing *Salmonella* in 1996. In NARMS, every 10th non-Typhi *Salmonella* isolate received at participating state public health laboratories is forwarded to CDC and tested by broth microdilution to determine partial range MICs to 17 antimicrobial agents.

Over the last quarter century, resistance among non-Typhi *Salmonella* has increased to a number of clinically important antimicrobial agents. Resistance to ampicillin and trimethoprim-sulfamethoxazole increased first, reaching 21% and 4%, respectively, in 1996. Resistance to third-generation cephalosporins (e.g., ceftriaxone), quinolones (e.g., nalidixic acid), and the ACSSuT resistance pattern increased more recently. A public health concern raised by this resistance is the loss of efficacious agents to treat serious *Salmonella* infections, especially in children. The clinical implications of current resistance levels are potential treatment failure, increased duration of illness, and increased length of hospitalization (3,5,6). For more information on treatment of *Salmonella* see <u>Diagnosis and Management of Foodborne Illness: A Primer for Physicians</u> (7).

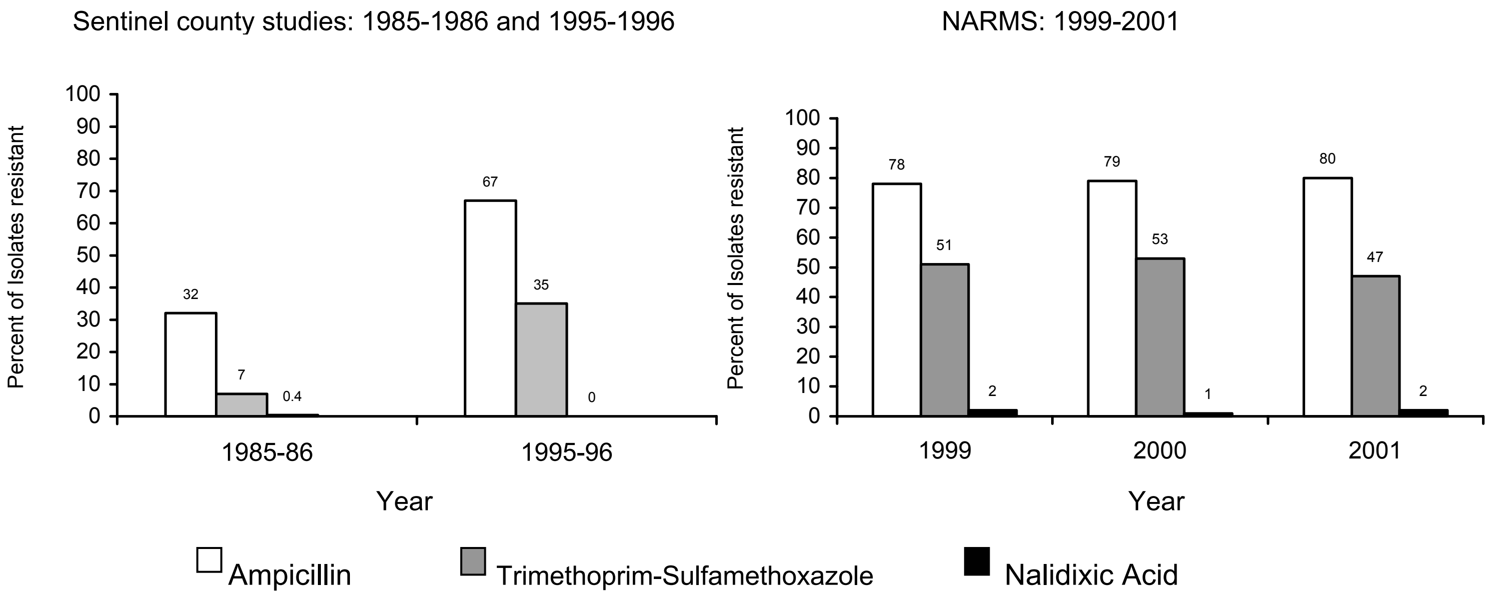
Summary of Long Term Changes in Antimicrobial Resistance in Campylobacter jejuni Isolates, 1989-2001



For *Campylobacter jejuni*, a sentinel county survey was conducted in 1989-90 (8). Isolates were received and tested at CDC. NARMS began testing *Campylobacter* in 1997. In NARMS, one *Campylobacter* isolate per week is forwarded to CDC from nine states and tested by E-test for susceptibility to eight antimicrobial agents.

Over the last quarter century, resistance among *Campylobacter jejuni* has increased to a number of clinically important antimicrobial agents. Resistance to tetracycline was already 42% in 1989-90. Resistance to ciprofloxacin increased more recently. No isolates resistant to ciprofloxacin were identified in 1989-90, 12% were resistant in 1997, and 18% in 2001. Resistance to erythromycin has remained low at 2% or less. Because the primary reservoir for *Campylobacter jejuni* is among poultry, it is likely that this increasing ciprofloxacin resistance is related to the use of fluoroquinolones, which were approved for use in poultry farming in 1995. A public health concern raised by this resistance is the threat to the efficacy of fluoroquinolones. The clinical implications of resistance to fluoroquinolones include an increased duration of illness and potential treatment failure (9). For more information on treatment of *Campylobacter* see Diagnosis and Management of Foodborne Illness: A Primer for Physicians (7).

Summary of Long Term Changes in Antimicrobial Resistance in Shigella Isolates, 1985-2001



For *Shigella*, sentinel county surveys were conducted in 1985-86 and 1995-96 (10). Isolates were received and tested at CDC. NARMS began testing *Shigella* in 1999. In NARMS, every 10th *Shigella* isolate received at participating state public health laboratories is forwarded to CDC and tested by broth microdilution to determine partial range MICs to 17 antimicrobial agents.

Over the last 17 years, resistance among *Shigella* has increased to a number of clinically important antimicrobial agents. Resistance to ampicillin was already 32% in 1985-86 and increased to 67% by 1995. Resistance to nalidixic acid emerged more recently. One *Shigella* isolate resistant to nalidixic acid was identified in 1985-86. The percentage of *Shigella* isolates resistant to nalidixic acid increased to 2% in 1999 and remains at 2% in 2001.

As *Shigella* have no environmental or animal reservoir except humans, it is likely that this resistance is related to the use of antimicrobials in human medicine. A public health concern raised by these resistances is the loss of efficacious agents to treat *Shigella* infections. The clinical implication of current resistance levels is potential treatment failure. This may be particularly important for infections related to international travel (10). For more information on treatment of *Shigella* see Diagnosis and Management of Foodborne Illness: A Primer for Physicians (7).

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Part II

Summary Tables and Graphs

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 1. Population size and number of isolates received and tested, by site, 2001

Site	Population Size*		Non-Typhi *Salmonella*		*Salmonella* Typhi		*Shigella*		*E. coli* O157		*Campylobacter* **	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
California (1)	3,204,675	(3)	53	(4)	18	(9)	20	(6)	8	(3)	50	(13)
Colorado	4,417,714	(4)	63	(4)	0	(0)	23	(7)	23	(8)	43	(11)
Connecticut	3,425,074	(3)	50	(3)	5	(2)	6	(2)	12	(4)	45	(12)
Florida	16,396,515	(15)	55	(4)	4	(2)	1	(0)	7	(2)	N/A	
Georgia	8,383,915	(8)	185	(13)	8	(4)	41	(12)	27	(10)	53	(14)
Kansas	2,694,641	(2)	28	(2)	0	(0)	5	(1)	4	(1)	N/A	
Los Angeles (2)	9,637,494	(9)	102	(7)	19	(10)	17	(5)	5	(2)	N/A	
Maryland	5,375,156	(5)	86	(6)	12	(6)	14	(4)	13	(5)	38	(10)
Massachusetts	6,379,304	(6)	131	(9)	10	(5)	19	(5)	22	(8)	N/A	
Minnesota	4,972,294	(5)	63	(4)	6	(3)	45	(13)	34	(12)	49	(13)
New Jersey	8,484,431	(8)	118	(8)	40	(20)	35	(10)	20	(7)	N/A	
New York City (3)	8,019,033	(7)	139	(10)	47	(24)	45	(13)	12	(4)	N/A	
New York State (4)	10,992,345	(10)	135	(9)	11	(6)	23	(7)	28	(10)	45	(12)
Oregon	3,472,867	(3)	26	(2)	9	(5)	10	(3)	13	(5)	28	(7)
Tennessee	5,740,021	(5)	84	(6)	2	(1)	12	(3)	10	(4)	33	(9)
Washington	5,987,973	(5)	76	(5)	6	(3)	23	(7)	32	(11)	N/A	
West Virginia	1,801,916	(2)	25	(2)	0	(0)	5	(1)	7	(2)	N/A	
Totals	109,385,368	(100)	1419	(100)	197	(100)	344	(100)	277	(100)	384	(100)

* County population 2001, U.S. Census Bureau, post-census estimates
** *Campylobacter* isolates are submitted only from FoodNet sites, population size of FoodNet sites is 34.3 million persons (see http://www.cdc.gov/foodnet/)
(1) Alameda, Contra Costa, and San Francisco 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, 2001

Antimicrobial Agent	Antimicrobial Agent Concentration Range (μg/ml)	Breakpoints [R]	[I]	[S]
Amikacin	4 - 32	≥ 64	32	≤ 16
Amoxicillin – Clavulanic Acid	0.5/0.25 – 32/16	≥ 32/16	16/8	≤ 8/4
Ampicillin	2 – 32	≥ 32	16	≤ 8
Apramycin**	2 – 32	≥ 64	16 – 32	≤ 8
Azithromycin	0.016 – 256*	≥ 2	0.5-1	≤ 0.25
Cefoxitin	4-32	≥ 32	16	≤ 8
Ceftiofur**	0.5 – 16	≥ 8	4	≤ 2
Ceftriaxone	0.25 – 64	≥ 64	16 - 32	≤ 8
Cephalothin	1 – 32	≥ 32	16	≤ 8
Chloramphenicol	4 – 32 0.016 – 256*	≥ 32	16	≤ 8
Ciprofloxacin	0.015 – 4 0.002 – 32*	≥ 4	2	≤ 1
Clindamycin	0.016 – 256*	≥ 4	1-2	≤ 0.5
Erythromycin	0.016 – 256*	≥ 8	1-4	≤ 0.5
Gentamicin	0.25 – 16 0.016 – 256*	≥ 16	8	≤ 4
Imipenem	0.25 – 8	≥ 16	8	≤ 4
Kanamycin	16 – 64	≥ 64	32	≤ 16
Nalidixic Acid	4 –64 0.016 – 256*	≥ 32		≤ 16
Streptomycin	32 – 64	≥ 64		≤ 32
Sulfamethoxazole	128 – 512	≥ 512		≤ 256
Tetracycline	8 – 16 0.016 – 256*	≥ 16	8	≤ 4
Trimethoprim - Sulfamethoxazole	0.12/2.4 – 4/76	≥ 4/76		≤ 2/38

* *Campylobacter* antimicrobial agents and concentration ranges used
** No NCCLS interpretive standards for this antimicrobial agent

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 3. Results of ceftriaxone confirmatory testing for non-Typhi *Salmonella* isolates meeting screening criteria*, 2001

Isolate	Sensititre® MIC				By-hand broth microdilution MIC	
	Ceftiofur		Ceftriaxone		Ceftriaxone	
	μg/ml	S/I/R**	μg/ml	S/I/R***	μg/ml	S/I/R***
1	>16	R	32	I	64	R
2	16	R	4	S	64	R
3	>16	R	16	I	64	R
4	>16	R	8	S	64	R
5	>16	R	32	I	64	R
6	>16	R	32	I	64	R
7	>16	R	32	I	64	R
8	>16	R	16	I	64	R
9	16	R	8	S	64	R
10	16	R	8	S	64	R
11	>16	R	16	I	64	R
12	>16	R	16	I	64	R
13	>16	R	16	I	64	R
14	>16	R	8	S	64	R
15	>16	R	16	I	64	R
16	>16	R	32	I	64	R
17	>16	R	32	I	>64	R
18	>16	R	16	I	64	R
19	>16	R	16	I	>64	R
20	>16	R	16	I	64	R
21	>16	R	16	I	64	R
22	>16	R	16	I	64	R
23	>16	R	16	I	64	R
24	>16	R	32	I	>64	R
25	>16	R	32	I	>64	R
26	>16	R	16	I	64	R
27	16	R	16	I	64	R
28	>16	R	16	I	64	R
29	>16	R	32	I	>64	R
30	>16	R	8	S	64	R
31	>16	R	16	I	64	R
32	>16	R	16	I	64	R
33	>16	R	16	I	64	R
34	>16	R	16	I	64	R

*Decreased susceptibility to ceftiofur [MIC $\geq$ 4 μg/ml] and/or ceftriaxone [MIC $\geq$ 2 μg/ml], by Sensititre®
**Ceftiofur: S = Susceptible (MIC $\leq$ 2 μg/ml); I = Intermediate (MIC = 4 μg/ml); R = Resistant (MIC $\geq$ 8 μg/ml)
***Ceftriaxone: S = Susceptible (MIC $\leq$ 8 μg/ml); I = Intermediate (MIC 16-32 μg/ml); R = Resistant (MIC $\geq$ 64 μg/ml)

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 3. Results of ceftriaxone confirmatory testing for non-Typhi *Salmonella* isolates meeting screening criteria*, 2001

Isolate	Sensititre® MIC				By-hand broth microdilution MIC	
	Ceftiofur		Ceftriaxone		Ceftriaxone	
	µg/ml	S/I/R**	µg/ml	S/I/R***	µg/ml	S/I/R***
35	16	R	8	S	16	I
36	16	R	16	I	32	I
37	8	R	4	S	16	I
38	16	R	16	I	32	I
39	>16	R	16	I	32	I
40	16	R	8	S	32	I
41	16	R	8	S	32	I
42	16	R	8	S	32	I
43	16	R	8	S	32	I
44	8	R	8	S	16	I
45	16	R	16	I	32	I
46	>16	R	16	I	32	I
47	16	R	8	S	32	I
48	16	R	8	S	32	I
49	>16	R	2	S	<=0.125	S
50	4	S	<=0.250	S	0.5	S
51	>16	R	8	S	<=0.125	S
52	>16	R	2	S	<=0.125	S
53	>16	R	1	S	<=0.125	S
54	>16	R	0.500	S	<=0.125	S
55	>16	R	4	S	<=0.125	S
56	>16	R	2	S	<=0.125	S
57	>16	R	2	S	<=0.125	S
58	>16	R	4	S	<=0.125	S
59	>16	R	4	S	<=0.125	S
60	4	I	<=0.250	S	<=0.125	S

*Decreased susceptibility to ceftiofur [MIC $\geq$ 4 µg/ml] and/or ceftriaxone [MIC $\geq$ 2 µg/ml], by Sensititre®
**Ceftiofur: S = Susceptible (MIC ≤ 2 µg/ml); I = Intermediate (MIC = 4 µg/ml); R = Resistant (MIC $\geq$ 8 µg/ml)
***Ceftriaxone: S = Susceptible (MIC ≤ 8 µg/ml); I = Intermediate (MIC 16-32 µg/ml); R = Resistant (MIC ≥ 64 µg/ml)

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 4. Antimicrobial resistance of *Salmonella, Shigella,* and *E. coli* O157 isolates, 2001

Antimicrobial Agent	Non-Typhi *Salmonella* (N=1419)		*Salmonella* Typhi (N=197)		*Shigella* (N=344)		*E. coli* O157 (N=277)	
	N	**%**	**N**	**%**	N	%	**N**	**%**
Amikacin	0	(0)	0	(0)	0	(0)	0	(0)
Amoxicillin – Clavulanic Acid	66	(5)	0	(0)	15	(4)	2	(1)
Ampicillin	247	(17)	40	(20)	274	(80)	6	(2)
Apramycin	0	(0)	0	(0)	0	(0)	0	(0)
Cefoxitin	48	(3)	1	(0.5)	4	(1)	2	(1)
Ceftiofur	58	(4)	0	(0)	0	(0)	3	(1)
Ceftriaxone	34	(2)	0	(0)	0	(0)	0	(0)
Cephalothin	57	(4)	1	(0.5)	31	(9)	4	(1)
Chloramphenicol	164	(12)	41	(21)	74	(21)	4	(1)
Ciprofloxacin	3	(0.2)	0	(0)	1	(0.3)	0	(0)
Gentamicin	27	(2)	0	(0)	0	(0)	1	(0.4)
Imipenem	0	(0)	0	(0)	0	(0)	0	(0)
Kanamycin	68	(5)	1	(0.5)	2	(1)	0	(0)
Nalidixic Acid	37	(3)	59	(30)	6	(2)	3	(1)
Streptomycin	241	(17)	40	(20)	183	(53)	5	(2)
Sulfamethoxazole	251	(18)	41	(21)	194	(56)	14	(5)
Tetracycline	280	(20)	41	(21)	204	(59)	15	(5)
Trimethoprim - Sulfamethoxazole	28	(2)	41	(21)	161	(47)	2	(1)

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 5a. Additional resistance by antimicrobial agent for non-Typhi *Salmonella*, 2001

Resistance to: N (%)	Amika	Amo-Cl	Ampic	Apram	Cefox	Cefti	Ceftr	Cepha	Chlor	Cipro	Genta	Imipe	Kanam	Naldx	Strep	Sulfa	Tetra	Tri-Su
Amikacin [Amika] 0 (0)		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Amox-Clav [Amo-Cl] 66 (5)	0 0%		65 98%	0 0%	48 73%	52 79%	34 51%	50 76%	47 71%	2 3%	4 6%	0 0%	11 17%	3 4%	50 76%	53 80%	47 71%	3 4%
Ampicillin [Ampic] 247 (17)	0 0%	65 26%		0 0%	48 19%	53 21%	34 14	55 22%	157 64%	3 1%	9 4%	0 0%	43 17%	8 3%	176 71%	193 78%	191 77%	14 6%
Apramycin [Apram] 0 (0)	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Cefoxitin [Cefox] 48 (3)	0 0%	48 100%	48 100%	0 0%		47 98%	34 71%	48 100%	36 75%	0 0%	3 6%	0 0%	9 19%	1 2%	39 81%	38 79%	37 77%	1 2%
Ceftiofur [Cefti] 58 (4)	0 0%	52 90%	53 91%	0 0%	47 81%		34 59%	48 83%	36 62%	1 2%	4 7%	0 0%	10 17%	2 3%	38 65%	41 71%	37 64%	1 2%
Ceftriaxone [Ceftr] 34 (2)	0 0%	34 100%	34 100%	0 0%	34 100%	34 100%		34 100%	30 88%	0 0%	2 6%	0 0%	7 21%	0 0%	32 94%	31 91%	31 91%	1 3%
Cephalothin [Cepha] 57 (4)	0 0%	50 88%	55 96%	0 0%	48 84%	48 84%	34 60%		38 67%	2 3%	5 9%	0 0%	14 25%	4 7%	43 75%	42 74%	38 67%	3 5%
Chloramphenicol [Chlor] 164 (12)	0 0%	47 29%	157 96%	0 0%	36 22%	36 22%	30 18%	38 23%		2 1%	6 4%	0 0%	17 10%	2 1%	147 90%	162 99%	162 99%	11 7%
Ciprofloxacin [Cipro] 3 (0.2)	0 0%	2 67%	3 100%	0 0%	0 0%	1 33%	0 0%	2 67%	2 67%		2 67%	0 0%	2 67%	3 100%	1 33%	2 67%	1 33%	1 33%
Gentamicin [Genta] 27 (2)	0 0%	4 15%	9 33%	0 0%	3 11%	4 15%	2 7%	5 18%	6 22%	2 7%		0 0%	7 26%	2 7%	23 85%	26 96%	13 48%	4 15%
Imipenem [Imipe] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Kanamycin [Kanam] 68 (5)	0 0%	11 16%	43 63%	0 0%	9 13%	10 15%	7 10%	14 21%	17 25%	2 3%	7 10%	0 0%		4 6%	56 82%	43 63%	58 85%	5 7%
Nalidixic Acid [Naldx] 37 (3)	0 0%	3 8%	8 22%	0 0%	1 3%	2 5%	0 0%	4 11%	2 5%	3 8%	2 5%	0 0%	4 11%		3 8%	5 13%	6 16%	4 11%
Streptomycin [Strep] 241 (17)	0 0%	50 21%	176 73%	0 0%	39 16%	38 16%	32 13%	43 18%	147 61%	1 0.4%	23 9%	0 0%	56 23%	3 1%		202 84%	212 88%	13 5%
Sulfamethoxazole [Sulfa] 251 (18)	0 0%	53 21%	193 77%	0 0%	38 15%	41 16%	31 12%	42 17%	162 64%	2 1%	26 10%	0 0%	43 17%	5 2%	202 80%		210 84%	27 11%
Tetracycline [Tetra] 280 (20)	0 0%	47 17%	191 68%	0 0%	37 13%	37 13%	31 11%	38 14%	162 58%	1 0.4%	13 5%	0 0%	58 21%	6 2%	212 76%	210 75%		19 7%
Trimeth-Sulfa [Tri-Su] 28 (2)	0 0%	3 11%	14 50%	0 0%	1 4%	1 4%	1 4%	3 11%	11 39%	1 4%	4 14%	0 0%	5 18%	4 14%	13 46%	27 96%	19 68%	

National Antimicrobial Resistance Monitoring System For Enteric Bacteria
Table 5b. Additional resistance by antimicrobial agent for *Salmonella* Typhi, 2001

Resistance to: N (%)	Amika	AmoCl	Ampic	Apram	Cefox	Cefti	Ceftr	Cepha	Chlor	Cipro	Genta	Imipe	Kanam	Naldx	Strep	Sulfa	Tetra	Tri-Su
Amikacin [Amika] 0 (0)		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Amox-Clav [Amo-Cl] 0 (0)	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Ampicillin [Ampic] 40 (20)	0 0%	0 0%		0 0%	0 0%	0 0%	0 0%	0 0%	38 95%	0 0%	0 0%	0 0%	1 2%	23 57%	38 95%	39 97%	36 90%	36 90%
Apramycin [Apram] 0 (0)	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Cefoxitin [Cefox] 1 (0.5)	0 0%	0 0%	0 0%	0 0%		0 0%	0 0%	1 100%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%
Ceftiofur [Cefti] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Ceftriaxone [Ceftr] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Cephalothin [Cepha] 1 (0.5)	0 0%	0 0%	0 0%	0 0%	1 100%	0 0%	0 0%		0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%
Chloramphenicol [Chlor] 41 (21)	0 0%	0 0%	38 93%	0 0%	0 0%	0 0%	0 0%	0 0%		0 0%	0 0%	0 0%	0 0%	26 63%	36 88%	37 90%	38 93%	38 93%
Ciprofloxacin [Cipro] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Gentamicin [Genta] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Imipenem [Imipe] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Kanamycin [Kanam] 1 (0.5)	0 0%	0 0%	1 100%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%		0 0%	1 100%	1 100%	1 100%	0 0%
Nalidixic Acid [Naldx] 59 (30)	0 0%	0 0%	23 39%	0 0%	0 0%	0 0%	0 0%	0 0%	26 44%	0 0%	0 0%	0 0%	0 0%		22 37%	22 37%	26 44%	24 41%
Streptomycin [Strep] 40 (20)	0 0%	0 0%	38 95%	0 0%	0 0%	0 0%	0 0%	0 0%	36 90%	0 0%	0 0%	0 0%	1 2%	22 55%		40 100%	34 85%	37 92%
Sulfamethoxazole [Sulfa] 41 (21)	0 0%	0 0%	39 95%	0 0%	0 0%	0 0%	0 0%	0 0%	37 90%	0 0%	0 0%	0 0%	1 2%	22 54%	40 98%		35 85%	38 93%
Tetracycline [Tetra] 41 (21)	0 0%	0 0%	36 88%	0 0%	0 0%	0 0%	0 0%	0 0%	38 93%	0 0%	0 0%	0 0%	1 2%	26 63%	34 83%	35 85%		35 85%
Trimeth-Sulfa [Tri-Su] 41 (21)	0 0%	0 0%	36 88%	0 0%	0 0%	0 0%	0 0%	0 0%	38 93%	0 0%	0 0%	0 0%	0 0%	24 58%	37 90%	38 93%	35 85%	

National Antimicrobial Resistance Monitoring System For Enteric Bacteria
Table 5c. Additional resistance by antimicrobial agent for *Shigella*, 2001

Resistance to: N (%)	Amika	AmoCl	Ampic	Apram	Cefox	Cefti	Ceftr	Cepha	Chlor	Cipro	Genta	Imipe	Kanam	Naldx	Strep	Sulfa	Tetra	Tri-Su
Amikacin [Amika] 0 (0)		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Amox-Clav [Amo-Cl] 15 (4)	0 0%		15 100%	0 0%	4 27%	0 0%	0 0%	10 67%	4 27%	0 0%	0 0%	0 0%	0 0%	0 0%	8 53%	10 67%	4 27%	9 60%
Ampicillin [Ampic] 274 (80)	0 0%	15 5%		0 0%	4 1%	0 0%	0 0%	31 11%	69 25%	1 0.4%	0 0%	0 0%	2 1%	3 1%	153 56%	152 55%	161 59%	129 47%
Apramycin [Apram] 0 (0)	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Cefoxitin [Cefox] 4 (1)	0 0%	4 100%	4 100%	0 0%		0 0%	0 0%	4 100%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	3 75%	3 75%	0 0%	3 75%
Ceftiofur [Cefti] 0 (0)	0 0%	0 0%	0 0%	0 0%	0 0%		0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%
Ceftriaxone [Ceftr] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Cephalothin [Cepha] 31 (9)	0 0%	10 32%	31 100%	0 0%	4 13%	0 0%	0 0%		1 3%	0 0%	0 0%	0 0%	0 0%	0 0%	24 77%	24 77%	17 55%	24 77%
Chloramphenicol [Chlor] 74 (21)	0 0%	4 5%	69 93%	0 0%	0 0%	0 0%	0 0%	1 1%		1 1%	0 0%	0 0%	0 0%	2 3%	41 55%	45 61%	72 97%	27 36%
Ciprofloxacin [Cipro] 1 (0.3)	0 0%	0 0%	1 100%	0 0%	0 0%	0 0%	0 0%	0 0%	1 100%		0 0%	0 0%	0 0%	1 100%	1 100%	1 100%	1 100%	1 100%
Gentamicin [Genta] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Imipenem [Imipe] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Kanamycin [Kanam] 2 (1)	0 0%	0 0%	2 100%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%		0 0%	2 100%	2 100%	2 100%	1 50%
Nalidixic Acid [Naldx] 6 (2)	0 0%	0 0%	3 50%	0 0%	0 0%	0 0%	0 0%	0 0%	2 33%	1 17%	0 0%	0 0%	0 0%		5 83%	5 83%	6 100%	5 83%
Streptomycin [Strep] 183 (53)	0 0%	8 4%	153 84%	0 0%	3 2%	0 0%	0 0%	24 13%	41 22%	1 0.5%	0 0%	0 0%	2 1%	5 3%		156 85%	148 81%	146 80%
Sulfamethoxazole [Sulfa] 194 (56)	0 0%	10 5%	152 78%	0 0%	3 1%	0 0%	0 0%	24 12%	45 23%	1 0.5%	0 0%	0 0%	2 1%	5 3%	156 80%		166 86%	158 81%
Tetracycline [Tetra] 204 (59)	0 0%	4 2%	161 79%	0 0%	0 0%	0 0%	0 0%	17 8%	72 35%	1 0.5%	0 0%	0 0%	2 1%	6 3%	148 72%	166 81%		134 66%
Trimeth-Sulfa [Tri-Su] 161 (47)	0 0%	9 6%	129 80%	0 0%	3 2%	0 0%	0 0%	24 15%	27 17%	1 1%	0 0%	0 0%	1 1%	5 3%	146 91%	158 98%	134 83%	

National Antimicrobial Resistance Monitoring System For Enteric Bacteria
Table 5d. Additional resistance by antimicrobial agent for *E. coli* O157, 2001

Resistance to: N (%)	Amika	AmoCl	Ampic	Apram	Cefox	Cefti	Ceftr	Cepha	Chlor	Cipro	Genta	Imipe	Kanam	Naldx	Strep	Sulfa	Tetra	Tri-Su
Amikacin [Amika] 0 (0)		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Amox-Clav [Amo-Cl] 2 (1)	0 0%		2 100%	0 0%	2 100%	2 100%	0 0%	2 100%	1 50%	0 0%	0 0%	0 0%	0 0%	0 0%	1 50%	1 50%	1 50%	0 0%
Ampicillin [Ampic] 6 (2)	0 0%	2 33%		0 0%	2 33%	2 33%	0 0%	3 50%	1 17%	0 0%	0 0%	0 0%	0 0%	0 0%	2 33%	2 33%	2 33%	1 17%
Apramycin [Apram] 0 (0)	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Cefoxitin [Cefox] 2 (1)	0 0%	2 100%	2 100%	0 0%		2 100%	0 0%	2 100%	1 50%	0 0%	0 0%	0 0%	0 0%	0 0%	1 50%	1 50%	1 50%	0 0%
Ceftiofur [Cefti] 3 (1)	0 0%	2 67%	2 67%	0 0%	2 67%		0 0%	2 67%	1 33%	0 0%	0 0%	0 0%	0 0%	0 0%	1 33%	1 33%	1 33%	0 0%
Ceftriaxone [Ceftr] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Cephalothin [Cepha] 4 (1)	0 0%	2 50%	3 75%	0 0%	2 50%	2 50%	0 0%		2 50%	0 0%	0 0%	0 0%	0 0%	0 0%	3 75%	3 75%	3 75%	1 25%
Chloramphenicol [Chlor] 4 (1)	0 0%	1 25%	1 25%	0 0%	1 25%	1 25%	0 0%	2 50%		0 0%	0 0%	0 0%	0 0%	0 0%	3 75%	4 100%	4 100%	1 25%
Ciprofloxacin [Cipro] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Gentamicin [Genta] 1 (0.4)	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%		0 0%	0 0%	0 0%	1 100%	1 100%	0 0%	0 0%
Imipenem [Imipe] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Kanamycin [Kanam] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%
Nalidixic Acid [Naldx] 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 0%	0 0%	0 0%	0 0%
Streptomycin [Strep] 5 (2)	0 0%	1 20%	2 40%	0 0%	1 20%	1 20%	0 0%	3 60%	3 60%	0 0%	1 20%	0 0%	0 0%	0 0%		5 100%	4 80%	1 20%
Sulfamethoxazole [Sulfa] 14 (5)	0 0%	1 7%	2 14%	0 0%	1 7%	1 7%	0 0%	3 21%	4 29%	0 0%	1 7%	0 0%	0 0%	0 0%	5 36%		13 93%	2 14%
Tetracycline [Tetra] 15 (5)	0 0%	1 7%	2 13%	0 0%	1 7%	1 7%	0 0%	3 20%	4 27%	0 0%	0 0%	0 0%	0 0%	0 0%	4 27%	13 87%		2 13%
Trimeth-Sulfa [Tri-Su] 2 (1)	0 0%	0 0%	1 50%	0 0%	0 0%	0 0%	0 0%	1 50%	1 50%	0 0%	0 0%	0 0%	0 0%	0 0%	1 50%	2 100%	2 100%	

National Antimicrobial Resistance Monitoring System For Enteric Bacteria
Table 5e. Additional resistance by antimicrobial agent for *Campylobacter*, 2001

Resistance to: N (%)	Azith	Chlor	Cipro	Clind	Eryth	Genta	Naldx	Tetra
Azithromycin [Azith] 8 (2)		0 0%	3 37%	8 100%	8 100%	0 0%	3 37%	3 37%
Chloramphenicol [Chlor] 0 (0)	0 100%		0 100%	0 100%	0 100%	0 100%	0 100%	0 100%
Ciprofloxacin [Cipro] 75 (19)	3 4%	0 0%		3 4%	3 4%	0 0%	73 97%	42 56%
Clindamycin [Clind] 8 (2)	8 100%	0 0%	3 37%		8 100%	0 0%	3 37%	3 37%
Erythromycin [Eryth] 8 (2)	8 100%	0 0%	3 37%	8 100%		0 0%	3 37%	3 37%
Gentamicin [Genta] 0 (0)	0 100%	0 100%	0 100%	0 100%	0 100%		0 100%	0 100%
Nalidixic Acid [Naldx] 77 (20)	3 4%	0 0%	73 95%	3 4%	3 4%	0 0%		43 56%
Tetracycline [Tetra] 156 (41)	3 2%	0 0%	42 27%	3 2%	3 2%	0 0%	43 28%	

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 6. The 16 most common non-Typhi *Salmonella* serotypes, 2001

Serotype	N	%
Typhimurium	325	23
Enteritidis	282	20
Newport	124	9
Heidelberg	100	7
Javiana	51	4
Oranienburg	33	2
Montevideo	29	2
Muenchen	29	2
Thompson	27	2
Saint Paul	21	1
Berta	18	1
Braenderup	18	1
Agona	17	1
Infantis	17	1
Java	17	1
Stanley	17	1
Not serotyped	20	1
Other serotypes	274	19
Total	**1419**	**100**

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 7. Frequency of pansusceptibility*, and resistance to one or more antimicrobial agents, among the 16 most common non-Typhi *Salmonella* serotypes, 2001

Serotype	Total Isolates		Pansusceptible Isolates		Resistant Isolates	
	Number	% of *Salmonella*	Number	% of Serotype	Number	% of Serotype
Javiana	51	4	51	100	0	0
Oranienburg	33	2	32	97	1	3
Thompson	27	2	26	96	1	4
Infantis	17	1	16	94	1	6
Montevideo	29	2	26	90	3	10
Muenchen	29	2	25	86	4	14
Enteritidis	282	20	242	86	40	14
Java	17	1	14	82	3	18
Saint Paul	21	1	17	81	4	19
Braenderup	18	1	14	78	4	22
Newport	124	9	81	65	43	35
Heidelberg	100	7	64	64	36	36
Berta	18	1	10	56	8	44
Stanley	17	1	9	53	8	47
Typhimurium	325	23	160	49	165	51
Agona	17	1	8	47	9	53

*Pansusceptible to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 8. Frequency of resistance and multidrug* resistance among the 16 most common non-Typhi *Salmonella* serotypes, 2001

Serotype	Total		Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Number resistant to ≥ 8 antimicrobial agents	
	N	%	N	%	N	%	N	%	N	%
Typhimurium	325	23	165	51	156	48	114	35	5	1
Enteritidis	282	20	40	14	16	6	3	1	1	0.4
Newport	124	9	43	35	39	31	33	27	31	25
Heidelberg	100	7	36	36	30	30	5	5	1	1
Javiana	51	4	0	0	0	0	0	0	0	0
Oranienburg	33	2	1	3	1	3	0	0	0	0
Montevideo	29	2	3	10	2	7	1	3	0	0
Muenchen	29	2	4	14	4	14	0	0	0	0
Thompson	27	2	1	4	0	0	0	0	0	0
Saint Paul	21	1	4	19	4	19	1	5	1	5
Berta	18	1	8	44	3	17	0	0	0	0
Braenderup	18	1	4	22	2	11	0	0	0	0
Agona	17	1	9	53	5	29	0	0	0	0
Infantis	17	1	1	6	1	6	0	0	0	0
Java	17	1	3	18	3	18	3	18	0	0
Stanley	17	1	8	47	8	47	1	6	0	0
Other Serotypes	274	19	64	23	41	15	15	5	1	0.4
Total Serotyped	1399	100	394	28	315	22	176	13	40	3
Not Serotyped	20	NA	0	0	0	0	0	0	0	0

*Multidrug resistant to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

Table 9. Frequency of multidrug* resistance among the most common non-Typhi *Salmonella* serotypes in each site, 2001

Site	Most Common Serotypes	Total		Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Number resistant to ≥ 8 antimicrobial agents	
		N	%	N	%	N	%	N	%	N	%
California	Heidelberg	9	17	2	22	2	22	0	0	0	0
	Typhimurium	9	17	5	55	4	44	2	22	0	0
	Newport	6	11	5	83	5	83	5	83	5	83
	Enteritidis	5	9	1	20	0	0	0	0	0	0
	Oranienburg	3	6	0	0	0	0	0	0	0	0
	Other serotypes	21	40	2	9	1	5	0	0	0	0
	Total	53	100	15	28	12	23	7	13	5	9
Colorado	Typhimurium	20	32	10	50	10	50	8	40	1	5
	Enteritidis	8	13	1	12	0	0	0	0	0	0
	Heidelberg	8	13	2	25	2	25	0	0	0	0
	Braenderup	4	6	2	50	2	50	0	0	0	0
	Newport	4	6	1	25	1	25	1	25	1	25
	Other	19	30	4	21	2	10	0	0	0	0
	Total	63	100	20	32	17	27	9	14	2	3

*Multidrug resistant to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

Table 9. Frequency of multidrug* resistance among the most common non-Typhi *Salmonella* serotypes in each site, 2001

Site	Most Common Serotypes	Total		Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Number resistant to ≥ 8 antimicrobial agents	
		N	%	N	%	N	%	N	%	N	%
Connecticut	Enteritidis	15	30	4	27	1	7	1	7	1	7
	Typhimurium	11	22	8	73	8	73	6	54	1	9
	Newport	7	14	3	43	3	43	3	43	3	43
	Montevideo	3	6	0	0	0	0	0	0	0	0
	Oranienburg	2	4	0	0	0	0	0	0	0	0
	Thompson	2	4	0	0	0	0	0	0	0	0
	Other	10	20	2	20	2	20	0	0	0	0
	Total	50	100	17	34	14	28	10	20	5	10
Florida	Javiana	15	27	0	0	0	0	0	0	0	0
	Newport	10	18	1	10	1	10	1	10	0	0
	Enteritidis	7	13	2	29	0	0	0	0	0	0
	Typhimurium	5	9	2	40	2	40	1	20	0	0
	Lindenberg	2	4	0	0	0	0	0	0	0	0
	Manhattan	2	4	0	0	0	0	0	0	0	0
	Muenchen	2	4	1	50	1	50	0	0	0	0
	Rubislaw	2	4	0	0	0	0	0	0	0	0
	Other	10	18	1	10	1	10	1	10	0	0
	Total	55	100	7	13	5	9	3	5	0	0

*Multidrug resistant to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 9. Frequency of multidrug* resistance among the most common non-Typhi *Salmonella* serotypes in each site, 2001

Site	Most Common Serotypes	Total		Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Number resistant to ≥ 8 antimicrobial agents	
		N	%	N	%	N	%	N	%	N	%
Georgia	Typhimurium	38	20	22	58	21	55	16	42	0	0
	Newport	35	19	3	9	2	6	1	3	1	3
	Javiana	18	10	0	0	0	0	0	0	0	0
	Heidelberg	15	8	9	60	9	60	0	0	0	0
	Enteritidis	11	6	2	18	0	0	0	0	0	0
	Not serotyped	6	3	0	0	0	0	0	0	0	0
	Other serotypes	62	33	8	13	6	10	1	2	0	0
	Total	185	100	44	52	38	20	18	10	1	0.5
Kansas	Typhimurium	9	32	3	33	3	33	2	22	0	0
	Enteritidis	5	18	1	20	1	20	1	20	0	0
	Newport	5	18	0	0	0	0	0	0	0	0
	Heidelberg	2	7	2	100	2	100	0	0	0	0
	Oranienburg	2	7	0	0	0	0	0	0	0	0
	Not serotyped	1	4	0	0	0	0	0	0	0	0
	Other serotypes	4	14	0	0	0	0	0	0	0	0
	Total	28	100	6	21	6	21	3	11	0	0

*Multidrug resistant to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

Table 9. Frequency of multidrug* resistance among the most common non-Typhi *Salmonella* serotypes in each site, 2001

Site	Most Common Serotypes	Total		Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Number resistant to ≥ 8 antimicrobial agents	
		N	%	N	%	N	%	N	%	N	%
Los Angeles County	Enteritidis	21	21	0	0	0	0	0	0	0	0
	Typhimurium	18	18	8	44	8	44	6	33	0	0
	Newport	8	8	4	50	3	37	3	37	3	37
	Heidelberg	7	7	3	43	3	43	0	0	0	0
	Agona	6	6	3	50	2	33	0	0	0	0
	Other serotypes	42	41	8	19	6	14	1	2	0	0
	Total	102	100	26	25	22	22	10	10	3	3
Maryland	Enteritidis	26	30	4	15	3	11	1	4	0	0
	Typhimurium	16	19	11	69	11	69	10	62	0	0
	Oranienburg	6	7	0	0	0	0	0	0	0	0
	Newport	5	6	2	40	2	40	2	40	2	40
	Hadar	3	3	3	100	2	67	0	0	0	0
	Javiana	3	3	0	0	0	0	0	0	0	0
	Not serotyped	2	2	0	0	0	0	0	0	0	0
	Other serotypes	25	29	6	24	4	16	0	0	0	0
	Total	86	100	26	30	22	26	11	13	2	2

*Multidrug resistant to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 9. Frequency of multidrug* resistance among the most common non-Typhi *Salmonella* serotypes in each site, 2001

Site	Most Common Serotypes	Total		Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Number resistant to ≥ 8 antimicrobial agents	
		N	%	N	%	N	%	N	%	N	%
Massachusetts	Enteritidis	46	35	7	15	4	9	0	0	0	0
	Typhimurium	26	20	12	46	12	46	9	35	0	0
	Heidelberg	7	5	2	29	1	14	1	14	0	0
	Newport	6	5	4	67	3	50	2	33	2	33
	Monophasic Typhimurium	5		0	0	0	0	0	0	0	0
	Not serotyped	2	1	0	0	0	0	0	0	0	0
	Other serotypes	39	30	6	15	4	10	4	10	1	3
	Total	131	100	31	24	24	18	14	11	3	2
Minnesota	Typhimurium	23	36	11	48	11	48	8	35	1	4
	Enteritidis	11	17	2	18	0	0	0	0	0	0
	Heidelberg	6	9	2	33	2	33	1	17	0	0
	Java	3	5	0	0	0	0	0	0	0	0
	Newport	3	5	1	33	1	33	1	33	1	33
	Other serotypes	15	24	2	13	1	7	0	0	0	0
	Not serotyped	2	3	0	0	0	0	0	0	0	0
	Total	63	100	18	29	15	24	11	17	2	3

*Multidrug resistant to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

Table 9. Frequency of multidrug* resistance among the most common non-Typhi *Salmonella* serotypes in each site, 2001

Site	Most Common Serotypes	Total		Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Number resistant to ≥ 8 antimicrobial agents	
		N	%	N	%	N	%	N	%	N	%
New Jersey	Enteritidis	32	27	3	9	2	6	0	0	0	0
	Typhimurium	28	24	20	74	20	74	13	48	0	0
	Newport	8	7	3	37	2	25	1	12	1	12
	Heidelberg	4	3	1	25	1	25	0	0	0	0
	Braenderup	3	2	0	0	0	0	0	0	0	0
	Infantis	3	2	1	33	1	33	0	0	0	0
	Javiana	3	2	0	0	0	0	0	0	0	0
	Monophasic Typhimurium	3	2	0	0	0	0	0	0	0	0
	Thompson	3	2	0	0	0	0	0	0	0	0
	Not serotyped	2	2	0	0	0	0	0	0	0	0
	Other serotypes	29	24	6	21	4	14	1	3	0	0
	Total	118	100	34	29	30	25	15	13	1	1

*Multidrug resistant to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 9. Frequency of multidrug* resistance among the most common non-Typhi *Salmonella* serotypes in each site, 2001

Site	Most Common Serotypes	Total		Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Number resistant to ≥ 8 antimicrobial agents	
		N	%	N	%	N	%	N	%	N	%
New York City	Enteritidis	43	31	9	21	3	7	0	0	0	0
	Typhimurium	32	23	17	8	14	44	7	22	0	0
	Berta	7	5	5	71	0	0	0	0	0	0
	Heidelberg	6	4	2	33	1	17	0	0	0	0
	Muenchen	4	3	1	25	1	25	0	0	0	0
	Uganda	4	3	0	0	0	0	0	0	0	0
	Other serotypes	43	31	19	44	12	28	5	12	0	0
	Total	139	100	53	38	31	22	12	9	0	0
New York State	Typhimurium	36	27	14	39	11	30	10	28	0	0
	Enteritidis	23	17	1	4	0	0	0	0	0	0
	Heidelberg	16	12	4	25	1	6	1	6	0	0
	Newport	8	6	6	75	6	75	4	50	4	50
	Thompson	7	5	0	0	0	0	0	0	0	0
	Not serotyped	1	1	0	0	0	0	0	0	0	0
	Other serotypes	44	33	8	18	6	14	3	7	0	0
	Total	135	100	33	24	24	18	18	13	4	3

*Multidrug resistant to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 9. Frequency of multidrug* resistance among the most common non-Typhi *Salmonella* serotypes in each site, 2001

Site	Most Common Serotypes	Total N	Total %	Number resistant to ≥ 1 antimicrobial agents N	%	Number resistant to ≥ 2 antimicrobial agents N	%	Number resistant to ≥ 5 antimicrobial agents N	%	Number resistant to ≥ 8 antimicrobial agents N	%
Oregon	Typhimurium	10	38	2	20	2	20	2	20	0	0
	Enteritidis	4	15	0	0	0	0	0	0	0	0
	Muenchen	3	11	0	0	0	0	0	0	0	0
	Montevideo	2	8	0	0	0	0	0	0	0	0
	Other serotypes	7	27	2	29	1	14	0	0	0	0
	Total	26	100	4	15	3	11	2	8	0	0
Tennessee	Typhimurium	23	27	12	52	11	48	9	39	0	0
	Newport	9	11	2	22	2	22	2	22	2	22
	Heidelberg	7	8	2	29	2	29	0	0	0	0
	Javiana	5	6	0	0	0	0	0	0	0	0
	Mississippi	5	6	1	20	1	20	0	0	0	0
	Not serotyped	3	4	0	0	0	0	0	0	0	0
	Other serotypes	32	38	7	22	6	19	2	6	0	0
	Total	84	100	24	29	22	26	13	15	2	2

*Multidrug resistant to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

Table 9. Frequency of multidrug* resistance among the most common non-Typhi *Salmonella* serotypes in each site, 2001

Site	Most Common Serotypes	Total N	Total %	Number resistant to ≥ 1 antimicrobial agents N	Number resistant to ≥ 1 antimicrobial agents %	Number resistant to ≥ 2 antimicrobial agents N	Number resistant to ≥ 2 antimicrobial agents %	Number resistant to ≥ 5 antimicrobial agents N	Number resistant to ≥ 5 antimicrobial agents %	Number resistant to ≥ 8 antimicrobial agents N	Number resistant to ≥ 8 antimicrobial agents %
Washington	Enteritidis	15	20	2	13	2	13	0	0	0	0
	Typhimurium	15	20	8	53	8	53	5	33	2	13
	Saint Paul	10	13	3	30	3	30	1	10	1	10
	Heidelberg	9	12	4	44	3	33	2	22	1	11
	Newport	7	9	5	71	5	71	4	57	4	57
	Not serotyped	1	1	0	0	0	0	0	0	0	0
	Other serotypes	19	25	7	37	4	21	1	5	0	0
	Total	76	100	29	38	25	33	13	17	8	10
West Virginia	Enteritidis	6	24	1	17	0	0	0	0	0	0
	Typhimurium	6	24	0	0	0	0	0	0	0	0
	Montevideo	3	12	0	0	0	0	0	0	0	0
	Newport	2	8	2	100	2	100	2	100	2	100
	Paratyphi	2	8	1	50	1	50	1	50	0	0
	Other serotypes	6	24	2	33	2	33	0	0	0	0
	Total	25	100	6	24	5	20	3	12	2	8

*Multidrug resistant to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 10. *Salmonella* Typhimurium isolates with at least ACSSuT*, ACKSSuT**, or AKSSuT*** resistance patterns, by site, 2001

Site	# non-Typhi *Salmonella* isolates tested	*Salmonella* Typhimurium		ACSSuT Typhimurium		ACKSSuT Typhimurium		AKSSuT Typhimurium	
		N	%	N	%	N	%	N	%
California	53	9	17	1	11	0	0	1	11
Colorado	63	20	32	5	26	0	0	3	15
Connecticut	50	11	22	5	45	0	0	0	0
Florida	55	5	9	1	20	0	0	0	0
Georgia	185	38	20	15	39	2	5	3	8
Kansas	28	9	32	1	12	0	0	1	12
Los Angeles	102	18	18	4	22	0	0	2	11
Maryland	86	16	19	8	50	0	0	0	0
Massachusetts	131	26	20	7	27	0	0	1	4
Minnesota	63	23	36	6	26	0	0	1	4
New Jersey	118	28	24	13	48	0	0	0	0
New York City	139	32	23	6	19	1	3	1	3
New York State	135	36	27	8	22	0	0	1	3
Oregon	26	10	38	2	20	0	0	0	0
Tennessee	84	23	27	9	39	0	0	0	0
Washington	76	15	20	5	33	1	7	1	7
West Virginia	25	6	24	0	0	0	0	0	0
Totals	**1419**	**325**	**23**	**96**	**30**	**4**	**1**	**15**	**5**

*ACSSuT= Ampicillin, Chloramphenicol, Streptomycin, Sulfamethoxazole, Tetracycline
**ACKSSuT= Ampicillin, Chloramphenicol, Kanamycin, Streptomycin, Sulfamethoxazole, Tetracycline
***AKSSuT= Ampicillin, Kanamycin, Streptomycin, Sulfamethoxazole, Tetracycline

Table 11. Additional antimicrobial resistance for *Salmonella* Typhimurium isolates with at least ACSSuT*, ACKSSuT, or AKSSuT*** resistance patterns, 2001**

Antimicrobial Agent	ACSSuT (N=96)		ACKSSuT (N=4)		AKSSuT (N=15)	
	N	**%**	**N**	**%**	**N**	**%**
Amikacin	0	0	0	0	0	0
Amoxicillin-Clavulanic Acid	13	13	1	25	1	7
Apramycin	0	0	0	0	0	0
Cefoxitin	4	4	1	25	1	7
Ceftiofur	4	4	1	25	1	7
Ceftriaxone	1	1	1	25	1	7
Cephalothin	4	4	1	25	1	7
Chloramphenicol	NA		NA		4	27
Ciprofloxacin	1	1	0	0	0	0
Gentamicin	2	2	0	0	1	7
Kanamycin	4	4	NA		NA	
Nalidixic Acid	1	1	0	0	0	0
Trimethoprim-Sulfamethoxazole	3	3	0	0	1	7

**ACSSuT=Ampicillin, Chloramphenicol, Streptomycin, Sulfamethoxazole, Tetracycline
***ACKSSuT=Ampicillin, Chloramphenicol, Kanamycin, Streptomycin, Sulfamethoxazole, Tetracycline
****AKSSuT=Ampicillin, Kanamycin, Streptomycin, Sulfamethoxazole, Tetracycline

NA: Not Applicable

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 12. *Salmonella* Newport isolates with at least MDR-AmpC* resistance pattern, by site, 2001

Site	# non-Typhi *Salmonella* isolates tested	*Salmonella* Newport		MDR-AmpC Newport	
		N	%	N	%
California	53	6	11	5	83
Colorado	63	4	6	1	25
Connecticut	50	7	14	3	43
Florida	55	10	18	0	0
Georgia	185	35	19	1	3
Kansas	28	5	18	0	0
Los Angeles	102	8	8	3	37
Maryland	86	5	6	2	40
Massachusetts	131	6	5	2	33
Minnesota	63	3	5	1	33
New Jersey	118	8	7	1	12
New York City	139	1	1	0	0
New York State	135	8	6	4	50
Oregon	26	0	0	0	0
Tennessee	84	9	11	2	22
Washington	76	7	9	4	57
West Virginia	25	2	8	2	100
Totals	**1419**	**124**	**9**	**31**	**25**

*MDR-AmpC=Resistance to Amoxicillin/Clavulanic Acid, Ampicillin, Cephalothin, Cefoxitin, Ceftiofur, Chloramphenicol, Sulfamethoxazole, Streptomycin and Tetracycline, and decreased susceptibility to Ceftriaxone (MIC $\geq$ 16 μg/ml)

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 13. Additional antimicrobial resistance for *Salmonella* Newport isolates with at least MDR-AmpC* resistance pattern, 2001

Antimicrobial Agent	MDR-AmpC (N=31)	
	N	%
Amikacin	0	0
Apramycin	0	0
Ceftriaxone	29	93
Ciprofloxacin	0	0
Gentamicin	2	6
Kanamycin	6	19
Nalidixic Acid	0	0
Trimethoprim-Sulfamethoxazole	1	3

*MDR-AmpC=Resistance to Amoxicillin/Clavulanic Acid, Ampicillin, Cephalothin, Cefoxitin, Ceftiofur, Chloramphenicol, Sulfamethoxazole, Streptomycin and Tetracycline, and decreased susceptibility to Ceftriaxone (MIC ≥ 16 μg/ml)

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 14. Most common multidrug* resistant patterns among non-Typhi *Salmonella*, 2001

Resistance pattern	Number	% of *Salmonella*	% of multidrug-resistant *Salmonella*
S. Typhimurium ACSSuT**	96	7	30
S. Typhimurium AKSSuT***	15	1	5
S. Newport MDR-AmpC****	31	2	10

*Multidrug resistant to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole

**ACSSUT = Ampicillin, Chloramphenicol, Streptomycin, Sulfamethoxazole, and Tetracycline
***AKSSuT = Ampicillin, Kanamycin, Streptomycin, Sulfamethoxazole, and Tetracycline

****MDR-AmpC = Resistance to Amoxicillin/Clavulanic Acid, Ampicillin, Cephalothin, Cefoxitin, Ceftiofur, Chloramphenicol, Sulfamethoxazole, Streptomycin and Tetracycline, and decreased susceptibility to Ceftriaxone (MIC $\geq$ 16 μg/ml)

National Antimicrobial Resistance Monitoring System for Enteric Bacteria

Table 15. Clinical source of non-Typhi *Salmonella* isolates, 2001

Isolate	Blood		Stool		Other		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
S. Typhimurium	11	3	283	87	23	7	8	2	325	23
S. Typhimurium -- ACSSuT	3	3	85	88	7	7	1	1	96	7
S. Typhimurium -- AKSSuT	1	7	14	93	0	0	0	0	15	1
All other *S.* Typhimurium	7	3	184	86	16	7	7	3	214	15
S. Enteritidis	16	6	251	89	8	3	7	2	282	20
S. Newport	0	0	116	93	7	6	1	1	124	9
S. Newport -- MDR-AmpC	0	0	28	90	3	10	0	0	31	2
All other *S.* Newport	0	0	88	95	4	4	1	1	93	6
S. Heidelberg	11	11	75	75	9	9	5	5	100	7
S. Javiana	0	0	47	92	3	6	1	2	51	4
S. Oranienburg	5	15	25	76	1	3	2	6	33	2
S. Montevideo	0	0	27	93	1	3	1	3	29	2
S. Muenchen	0	0	25	86	1	3	3	10	29	2
S. Thompson	1	4	25	93	1	4	0	0	27	2
S. St. Paul	0	0	18	86	3	14	0	0	21	1
S. Berta	1	5	14	78	3	17	0	0	18	1
S. Braenderup	0	0	17	94	1	6	0	0	18	1
S. Agona	0	0	16	94	0	0	1	6	17	1
S. Infantis	1	6	13	76	2	12	1	6	17	1
S. Java	1	6	12	71	3	18	1	6	17	1
S. Stanley	1	6	16	94	0	0	0	0	17	1
Other *Salmonella*	24	8	254	82	21	7	12	4	311	22
Total	**71**	**5**	**1218**	**86**	**87**	**6**	**43**	**3**	**1419**	**100**

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 16. Proportion of non-Typhi *Salmonella* isolates (N=1419) with clinically important resistance: decreased susceptibility or resistance to ciprofloxacin or ceftriaxone, 2001

Antimicrobial Agent	# isolates with decreased susceptibility*	% of *Salmonella*	# of resistant isolates**	% of *Salmonella*
Ciprofloxacin	15	1	3	0.2
Ceftriaxone	48	3	34	2

*Ciprofloxacin = MIC ≥ 0.25 μg/ml; Ceftriaxone = MIC ≥ 16 μg/ml
**Ciprofloxacin = MIC ≥ 4 μg/ml; Ceftriaxone = MIC ≥ 64 μg/ml

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 17. Proportion of non-Typhi *Salmonella* isolates submitted, by site, with decreased susceptibility to ciprofloxacin (MIC ≥ 0.25 μg/ml), 2001

Site	# isolates with decreased susceptibility	# non-Typhi *Salmonella* isolates tested	% with decreased susceptibility	Serotype
California	1	53	2	Paratyphi (1)
Colorado	1	63	2	Paratyphi (1)
Connecticut	1	50	2	Haardt (1)
Florida	1	55	2	Senftenberg* (1)
Georgia	0	185	0	
Kansas	0	28	0	
Los Angeles	1	102	1	Blockley (1)
Maryland	0	86	0	
Massachusetts	2	131	1	Agona (1), Senftenberg*(1)
Minnesota	0	63	0	
New Jersey	3	118	2	Paratyphi (2), Haifa (1)
New York City	2	139	1	Typhimurium (1), Virchow (1)
New York State	0	135	0	
Oregon	0	26	0	
Tennessee	1	84	1	Uganda (1)
Washington	2	76	3	Paratyphi (1), Typhimurium* (1)
West Virginia	0	25	0	
Total	**15**	**1419**	**1**	**Paratyphi (5), Senftenberg* (2), Typhimurium* (2), Agona (1), Blockley (1), Haardt (1), Haifa (1), Uganda (1), Virchow (1)**

*These isolates were also resistant to ciprofloxacin

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 18. Proportion of non-Typhi *Salmonella* isolates submitted, by site, with decreased susceptibility to ceftriaxone (MIC $\geq$ 16 μg/ml), 2001

Site	# isolates with decreased susceptibility	# non-Typhi *Salmonella* isolates tested	% with decreased susceptibility	Serotype
California	5	53	9	Newport* (5)
Colorado	2	63	2	Newport* (1), Typhimurium (1)
Connecticut	6	50	12	Newport* (3), Typhimurium* (2), Enteritidis* (1)
Florida	1	55	2	Senftenberg (1)
Georgia	1	185	0.5	Newport* (1)
Kansas	0	28	0	
Los Angeles	3	102	3	Newport* (3)
Maryland	4	86	5	Newport* (2), Typhimurium*(2)
Massachusetts	4	131	3	Newport* (2), Heidelberg (1), Typhimurium (1)
Minnesota	3	63	5	Montevideo (1), Newport* (1), Typhimurium (1)
New Jersey	1	118	1	Newport* (1)
New York City	1	139	1	Typhimurium (1)
New York State	7	135	5	Newport* (4), Heidelberg (1), Stanley (1), Typhimurium* (1)
Oregon	0	26	0	
Tennessee	2	84	2	Newport* (2)
Washington	6	76	8	Newport* (4), Heidelberg (1), Typhimurium* (1)
West Virginia	2	25	8	Newport* (2)
Total	**48**	**1419**	**3**	**Newport* (31), Typhimurium* (10), Heidelberg (3), Enteritidis* (1), Montevideo (1), Senftenberg (1), Stanley (1)**

*These isolates were also resistant to ceftriaxone

Table 19. Antimicrobial resistance of non-Typhi *Salmonella* isolates, 1996-2001

Salmonella, Non-Typhi	1996	1997	1998	1999	2000	2001
Salmonella isolates	1326	1301	1465	1498	1378	1419
Isolates resistant to ≥ 1 antimicrobial agents*	37% (493)	34% (443)	27% (397)	26% (390)	26% (353)	28% (394)
Isolates resistant to ≥ 2 antimicrobial agents*	31% (404)	25% (328)	23% (334)	21% (317)	21% (284)	22% (315)
Isolates resistant to ≥ 5 antimicrobial agents*	12% (163)	14% (180)	13% (189)	12% (174)	12% (161)	12% (170)
Isolates resistant to ≥ 8 antimicrobial agents*	0.3% (4)	1% (10)	1% (14)	2% (31)	3% (41)	3% (40)
Serotyped *Salmonella* isolates	93% (1231)	93% (1215)	96% (1410)	97% (1459)	97% (1332)	99% (1399)
Serotyped *Salmonella* which are Enteritidis	29% (357)	25% (301)	17% (244)	18% (270)	24% (319)	20% (282)
S. Enteritidis isolates resistant to ≥ 1 antimicrobial agents*	31% (110)	26% (78)	12% (30)	17% (45)	11% (35)	14% (40)
Serotyped *Salmonella* which are Typhimurium**	23% (306)	25% (326)	26% (377)	24% (362)	22% (303)	24% (325)
S. Typhimurium isolates resistant to ≥ 1 antimicrobial agents*	64% (196)	62% (202)	53% (200)	49% (179)	50% (153)	51% (165)
S. Typhimurium with at least ACSSuT resistance pattern	34% (103)	35% (115)	32% (120)	28% (102)	28% (84)	29% (96)
Salmonella isolates that were at least Typhimurium ACSSuT	8% (103)	9% (115)	8% (120)	7% (102)	6% (84)	7% (96)
S. Typhimurium with at least AKSSuT resistance pattern	9% (27)	13% (41)	12% (47)	11% (39)	9% (28)	5% (15)
Salmonella isolates that were at least Typhimurium AKSSuT	2% (27)	3% (41)	3% (47)	3% (39)	2% (28)	1% (15)
S. Typhimurium with at least ACKSSuT resistance pattern	4% (13)	3% (9)	4% (17)	3% (12)	3% (8)	1% (4)

*Using only antimicrobial agents (n=15) tested in all six years

**Includes *S*. Typhimurium and *S*. Typhimurium variant Copenhagen

***Amox-Clav=Amoxicillin-Clavulanic Acid

****Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

ŦE-test criteria include isolates with a ceftriaxone MIC of >=16µg/ml (1996-1998), by Sensititre®; By-hand broth microdilution criteria include isolates with a ceftiofur MIC of >=4µg/ml and/or ceftriaxone MIC of >=2µg/ml (1999-2001), by Sensititre®

Table 19. Summary: Antimicrobial resistance of non-Typhi *Salmonella* isolates, 1996-2001

Salmonella, Non-Typhi	1996	1997	1998	1999	2000	2001
Salmonella isolates that were at least Typhimurium ACKSSuT	1% (13)	1% (9)	1% (17)	1% (12)	1% (8)	0.3% (4)
S. Typhimurium isolates at least ACSSuT, AKSSuT, or ACKSSuT	42% (130)	48% (156)	44% (167)	39% (141)	37% (112)	34% (111)
Serotyped *Salmonella* which are Newport	4% (51)	4% (48)	5% (77)	7% (98)	9% (124)	9% (124)
S. Newport isolates resistant to $\geq$ 1 antimicrobial agents*	18% (9)	12% (6)	5% (4)	23% (23)	24% (30)	35% (43)
S. Newport with at least MDR-AmpC resistance pattern	0% (0)	0% (0)	1% (1)	17% (17)	22% (27)	25% (31)
Salmonella isolates that were at least Newport MDR-AmpC	0% (0)	0% (0)	0.1% (1)	1% (17)	2% (27)	2% (31)
Ciprofloxacin (MIC $\geq$ 0.25)	0.4% (5)	0.5% (7)	1% (10)	1% (15)	1% (20)	1% (15)
Ciprofloxacin (MIC $\geq$ 4)	0% (0)	0% (0)	0.1% (1)	0.1% (1)	0.4% (5)	0.2% (3)
Ceftriaxone (MIC $\geq$ 64)Ŧ	0.1% (1)	0.4% (5)	1% (10)	2% (24)	2% (25)	2% (34)
Nalidixic Acid (MIC $\geq$ 32)	0.4% (5)	1% (11)	1% (20)	1% (16)	2% (34)	3% (37)

*Using only antimicrobial agents (n=15) tested in all six years

**Includes *S*. Typhimurium and *S*. Typhimurium variant Copenhagen

***Amox-Clav=Amoxicillin-Clavulanic Acid

****Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

ŦE-test criteria include isolates with a ceftriaxone MIC of >=16µg/ml (1996-1998), by Sensititre®; By-hand broth microdilution criteria include isolates with a ceftiofur MIC of >=4µg/ml and/or ceftriaxone MIC of >=2µg/ml (1999-2001), by Sensititre®

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 19. Summary: Antimicrobial resistance of non-Typhi *Salmonella* isolates, 1996-2001

Salmonella, Non-Typhi	1996	1997	1998	1999	2000	2001
Amikacin (MIC ≥ 64)	Not Tested	0% (0)	0% (0)	0.1% (2)	0% (0)	0% (0)
Amox-Clav*** (MIC ≥ 32)	1% (20)	1% (19)	2% (24)	2% (36)	4% (54)	5% (66)
Ampicillin (MIC ≥ 32)	21% (279)	18% (241)	16% (241)	16% (234)	16% (219)	17% (247)
Apramycin (MIC ≥ 64)	0% (0)	0% (0)	0% (0)	0.3% (5)	0.1% (2)	0% (0)
Cefoxitin (MIC ≥ 32)	Not Tested	Not Tested	Not Tested	Not Tested	3% (43)	3% (48)
Ceftiofur (MIC ≥ 8)	4% (53)	3% (44)	1% (14)	2% (31)	3% (44)	4% (58)
Cephalothin (MIC ≥ 32)	3% (47)	3% (43)	2% (33)	4% (55)	4% (54)	4% (57)
Chloramphenicol (MIC ≥ 32)	11% (141)	10% (131)	10% (145)	9% (138)	10% (138)	12% (164)
Gentamicin (MIC ≥ 16)	5% (64)	3% (38)	3% (42)	2% (34)	3% (37)	2% (27)
Imipenem (MIC ≥ 16)	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	0% (0)
Kanamycin (MIC ≥ 64)	5% (65)	5% (66)	6% (84)	4% (66)	6% (77)	5% (68)
Streptomycin (MIC ≥ 64)	21% (275)	22% (282)	19% (273)	17% (253)	16% (223)	17% (241)
Sulfamethoxazole (MIC ≥ 512)	23% (305)	25% (328)	19% (283)	18% (271)	17% (235)	18% (251)
Tetracycline (MIC ≥ 16)	24% (321)	22% (283)	20% (295)	19% (291)	19% (256)	20% (280)
Trimeth-Sulfa**** (MIC ≥ 4/76)	4% (51)	2% (24)	2% (34)	2% (31)	2% (29)	2% (28)

*Using only antimicrobial agents (n=15) tested in all six years

**Includes *S*. Typhimurium and *S*. Typhimurium variant Copenhagen

***Amox-Clav=Amoxicillin-Clavulanic Acid

****Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

ŦE-test criteria include isolates with a ceftriaxone MIC of >=16µg/ml (1996-1998), by Sensititre®; By-hand broth microdilution criteria include isolates with a ceftiofur MIC of >=4µg/ml and/or ceftriaxone MIC of >=2µg/ml (1999-2001), by Sensititre®

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 20. Multidrug* resistance of non-Typhi *Salmonella* isolates, 1996-2001

Non-Typhi *Salmonella*

Year	# isolates tested	Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Resistant to at least ACSSuT**		Resistant to at least AKSSuT**		Resistant to ceftriaxone (MIC≥64 μg/ml)Ŧ		Decreased susceptibility to ciprofloxacin (MIC≥.25 μg/ml)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1996	1326	493	37	404	31	163	12	117	9	31	2	1	0.1	5	0.4
1997	1301	443	34	328	25	180	14	125	10	46	3	5	0.4	7	0.5
1998	1465	397	27	334	23	189	13	130	9	50	3	10	1	10	1
1999	1498	390	26	317	21	174	12	127	8	44	3	24	2	15	1
2000	1378	353	26	284	21	161	12	122	9	44	3	25	2	20	1
2001	1419	394	28	315	22	170	12	142	10	28	2	34	2	15	1

Salmonella Enteritidis

Year	# isolates tested	Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Resistant to at least ACSSuT**		Resistant to at least AKSSuT***		Resistant to ceftriaxone (MIC≥64 μg/ml) Ŧ‡		Decreased susceptibility to ciprofloxacin (MIC≥.25 μg/ml)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1996	357	110	31	84	23	13	4	1	0.3	0	0	0	0	3	1
1997	301	78	26	37	12	6	2	1	0.3	1	0.3	0	0	2	1
1998	244	30	12	16	7	0	0	0	0	0	0	0	0	2	1
1999	270	45	17	28	10	2	1	2	1	0	0	1	0.4	6	2
2000	319	35	11	9	3	0	0	0	0	0	0	0	0	1	0.3
2001	282	40	14	16	6	3	1	0	0	1	0.3	1	0.3	0	0

* Using only antimicrobial agents (n=15) tested in all six years
**ACSSuT = Ampicillin, Chloramphenicol, Streptomycin, Sulfamethoxazole, and Tetracycline
***AKSSuT= Ampicillin, Kanamycin, Streptomycin, Sulfamethoxazole, and Tetracycline
****MDR-AmpC=ACSSuT, amoxicillin-clavulanic acid, cephalothin, cefoxitin, ceftiofur, decreased susceptibility to ceftriaxone (MIC ≥ 16 μg/ml)
ŦE-test criteria include isolates with a ceftriaxone MIC of >=16μg/ml (1996-1998), by Sensititre®; By-hand broth microdilution criteria include isolates with a ceftiofur MIC of >=4μg/ml and/or ceftriaxone MIC of >=2μg/ml (1999-2001), by Sensititre®

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 20. Multidrug* resistance of non-Typhi *Salmonella* isolates, 1996-2001

Salmonella Typhimurium

Year	# isolates tested	Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Resistant to at least ACSSuT**		Resistant to at least AKSSuT**		Resistant to ceftriaxone (MIC≥64 μg/ml)Ŧ		Decreased susceptibility to ciprofloxacin (MIC≥.25 μg/ml)	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
1996	306	196	64	177	58	125	41	103	34	27	9	0	0	1	0.3
1997	326	204	63	188	58	154	47	115	35	41	13	5	1.5	1	0.3
1998	377	200	53	193	51	160	42	120	32	47	12	7	1.9	1	0.3
1999	362	179	49	167	46	132	36	102	28	39	11	5	1.4	1	0.3
2000	303	153	50	143	47	110	36	84	28	28	9	6	2	2	0.7
2001	325	164	51	155	48	111	34	96	30	14	4	4	1.2	2	0.6

Salmonella Newport

Year	# isolates tested	Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Number resistant to ≥ 8 antimicrobial agents		Resistant to at least MDR-AmpC****		Decreased susceptibility to Ciprofloxacin (MIC≥.25 μg/ml)	
		N	%	N	%	N	%	N	%	N	%	N	%
1996	51	9	18	4	8	3	6	2	4	0	0	0	0
1997	48	6	12	3	6	2	4	2	4	0	0	0	0
1998	77	4	5	2	3	2	3	2	3	1	1	0	0
1999	98	23	23	17	17	17	17	17	17	17	17	0	0
2000	124	30	24	28	23	28	23	27	22	27	22	0	0
2001	124	43	35	39	31	33	27	31	25	31	25	0	0

* Using only antimicrobial agents (n=15) tested in all six years

**ACSSuT = Ampicillin, Chloramphenicol, Streptomycin, Sulfamethoxazole, and Tetracycline

***AKSSuT= Ampicillin, Kanamycin, Streptomycin, Sulfamethoxazole, and Tetracycline

****MDR-AmpC=ACSSuT, amoxicillin-clavulanic acid, cephalothin, cefoxitin, ceftiofur, decreased susceptibility to ceftriaxone (MIC ≥ 16 μg/ml)

ŦE-test criteria include isolates with a ceftriaxone MIC of >=16μg/ml (1996-1998), by Sensititre®; By-hand broth microdilution criteria include isolates with a ceftiofur MIC of >=4μg/ml and/or ceftriaxone MIC of >=2μg/ml (1999-2001), by Sensititre®

Table 21. Antimicrobial resistance of *Salmonella* Typhi isolates, 1999-2001

Salmonella Typhi	1999	2000	2001
Salmonella Typhi isolates	166	177	197
Isolates resistant to ≥ 1 antimicrobial agents*	29% (49)	28% (50)	41% (81)
Isolates resistant to ≥ 2 antimicrobial agents*	15% (25)	12% (21)	23% (45)
Salmonella Typhi with at least ACSSuT resistance pattern	9% (15)	8% (14)	17% (33)
Salmonella Typhi with at least ACSuTm** resistance pattern	12% (20)	9% (16)	18% (35)
Amikacin (MIC ≥ 64)	0% (0)	1% (2)	0% (0)
Amox-Clav*** (MIC ≥ 32)	1% (1)	0% (0)	0% (0)
Ampicillin (MIC ≥ 32)	13% (21)	9% (16)	20% (40)
Apramycin (MIC ≥ 64)	0% (0)	1% (2)	0% (0)
Cefoxitin (MIC ≥ 32)	Not Tested	2% (3)	0.5% (1)
Ceftiofur (MIC ≥ 8)	1% (2)	1% (1)	0% (0)
Ceftriaxone (MIC ≥ 64)	0% (0)	0% (0)	0% (0)

*Using only antimicrobial agents (n=15) tested in all three years
**ACSuTm=Ampicillin, Chloramphenicol, Sulfamethoxazole-Trimethoprim
***Amox-Clav=Amoxicillin-Clavulanic Acid
****Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 21. Summary: Antimicrobial resistance of *Salmonella* Typhi isolates, 1999-2001

Salmonella Typhi	1999	2000	2001
Cephalothin (MIC ≥ 32)	2% (4)	1% (2)	0.5% (1)
Chloramphenicol (MIC ≥ 32)	12% (20)	11% (19)	21% (41)
Ciprofloxacin (MIC ≥ 0.25)	15% (25)	21% (38)	20% (39)
Ciprofloxacin (MIC ≥ 4)	0% (0)	0% (0)	0% (0)
Gentamicin (MIC ≥ 16)	0% (0)	1% (1)	0% (0)
Imipenem (MIC ≥ 16)	Not Tested	Not Tested	0% (0)
Kanamycin (MIC ≥ 64)	0% (0)	1% (1)	0.5% (1)
Nalidixic Acid (MIC ≥ 32)	19% (31)	23% (41)	30% (59)
Streptomycin (MIC ≥ 64)	14% (23)	10% (18)	20% (40)
Sulfamethoxazole (MIC ≥ 512)	17% (28)	12% (21)	21% (41)
Tetracycline (MIC ≥ 16)	9% (15)	11% (19)	21% (41)
Trimeth-Sulfa**** (MIC ≥ 4/76)	13% (21)	9% (16)	21% (41)

*Using only antimicrobial agents (n=15) tested in all three years
**ACSuTm=Ampicillin, Chloramphenicol, Sulfamethoxazole-Trimethoprim
***Amox-Clav=Amoxicillin-Clavulanic Acid
****Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

Table 22. Antimicrobial resistance of *E. coli* O157 isolates, 1996-2001

	1996	1997	1998	1999	2000	2001
E. coli O157 isolates	201	161	313	292	407	277
Isolates resistant to > 1 antimicrobial agents*	21% (42)	12% (20)	7% (23)	10% (30)	10% (40)	9% (24)
Isolates resistant to > 2 antimicrobial agents*	8% (15)	7% (11)	5% (17)	4% (12)	7% (27)	5% (15)
Amikacin (MIC > 64)	Not Tested	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)
Amox-Clav** (MIC > 32)	0% (0)	0% (0)	0% (0)	0.3% (1)	1% (4)	1% (2)
Ampicillin (MIC > 32)	1% (3)	0% (0)	3% (8)	1% (4)	3% (11)	2% (6)
Apramycin (MIC > 64)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)
Cefoxitin (MIC > 32)	Not Tested	Not Tested	Not Tested	Not Tested	1% (4)	1% (2)
Ceftiofur (MIC > 8)	5% (10)	0% (0)	0% (0)	0% (0)	1% (4)	1% (3)
Ceftriaxone (MIC > 64)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)
Cephalothin (MIC > 32)	3% (6)	4% (6)	0% (0)	1% (2)	1% (5)	1% (4)
Chloramphenicol (MIC > 32)	0.5% (1)	0% (0)	0.3% (1)	0% (0)	4% (15)	1% (4)
Ciprofloxacin (MIC > 4)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)
Gentamicin (MIC > 16)	0% (0)	0% (0)	0% (0)	0.3% (1)	0.5% (2)	0.4% (1)
Imipenem (MIC > 16)	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	0% (0)
Kanamycin (MIC > 64)	0% (0)	0% (0)	0.3% (1)	1% (2)	1% (4)	0% (0)
Nalidixic Acid (MIC > 32)	0% (0)	0% (0)	0% (0)	1% (2)	0.5% (2)	1% (3)
Streptomycin (MIC > 64)	2% (4)	2% (4)	2% (6)	3% (8)	5% (21)	2% (5)
Sulfamethoxazole (MIC > 512)	14% (28)	11% (17)	6% (18)	8% (24)	6% (24)	5% (14)
Tetracycline (MIC > 16)	5% (10)	3% (5)	4% (14)	3% (10)	7% (29)	5% (15)
Trimeth-Sulfa*** (MIC > 4/76)	0% (0)	0% (0)	1% (2)	1% (4)	1% (3)	1% (2)

*Using only antimicrobial agents (n=15) tested in all six years
**Amox-Clav=Amoxicillin-Clavulanic Acid
***Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

Table 23. Frequency of *Shigella* species, 2001

Species	N	%
sonnei	239	70
flexneri	91	26
boydii	5	1
dysenteriae	3	1
provisional *Shigella*	6	2
Total	**344**	**100**

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 24. Antimicrobial resistance of *Shigella* isolates, by *Shigella* species, 2001

Antimicrobial Agent	All *Shigella* (N=344)		*Shigella sonnei* (N=239)		*Shigella flexneri* (N=91)		*Shigella boydii* (N=5)	
	# Resistant	% Resistant	# Resistant	% Resistant	# Resistant	% Resistant	# Resistant	% Resistant
Amikacin	0	0	0	0	0	0	0	0
Amox-Clav*	15	4	11	5	4	4	0	0
Ampicillin	274	80	198	83	66	72	1	20
Apramycin	0	0	0	0	0	0	0	0
Cefoxitin	4	1	4	2	0	0	0	0
Ceftiofur	0	0	0	0	0	0	0	0
Ceftriaxone	0	0	0	0	0	0	0	0
Cephalothin	31	9	30	12	1	1	0	0
Chloramphenicol	74	21	3	1	68	75	0	0
Ciprofloxacin	1	0.3	0	0	1	1	0	0
Gentamicin	0	0	0	0	0	0	0	0
Imipenem	0	0	0	0	0	0	0	0
Kanamycin	2	1	1	0.4	1	1	0	0
Nalidixic Acid	6	2	2	1	3	3	1	20
Streptomycin	183	53	129	54	43	47	3	60
Sulfamethoxazole	194	56	130	54	52	57	4	80
Tetracycline	204	59	107	45	86	94	2	40
Trimethoprim-Sulfa**	161	47	121	51	31	34	2	40

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

Table 25. Antimicrobial resistance of *Shigella* isolates, 1999-2001

	1999	2000	2001
Shigella isolates	375	451	344
Isolates resistant to ≥ 1 antimicrobial agents*	91% (341)	93% (418)	95% (327)
Isolates resistant to ≥ 2 antimicrobial agents*	65% (245)	67% (302)	71% (244)
Shigella with at least ACSSuT resistance pattern	8% (32)	5% (25)	6% (22)
Shigella with at least ACSuTm** resistance pattern	10% (37)	7% (31)	7% (24)
Amikacin (MIC ≥ 64)	0% (0)	0.2% (1)	0% (0)
Amox-Clav*** (MIC ≥ 32)	1% (4)	2% (10)	4% (15)
Ampicillin (MIC ≥ 32)	78% (291)	79% (356)	80% (274)
Apramycin (MIC ≥ 64)	0% (0)	0.2% (1)	0% (0)
Cefoxitin (MIC ≥ 32)	Not Tested	0.4% (2)	1% (4)
Ceftiofur (MIC ≥ 8)	0% (0)	0% (0)	0% (0)
Ceftriaxone (MIC ≥ 64)	0% (0)	0% (0)	0% (0)

*Using only antimicrobial agents (n=15) tested in all three years
**ACSuTm=Ampicillin, Chloramphenicol, Sulfamethoxazole-Trimethoprim
***Amox-Clav=Amoxicillin-Clavulanic Acid
****Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

Table 25. Summary: Antimicrobial resistance of *Shigella* isolates, 1999-2001

	1999	2000	2001
Cephalothin (MIC $\geq$ 32)	3% (12)	8% (36)	9% (31)
Chloramphenicol (MIC $\geq$ 32)	17% (65)	14% (63)	21% (74)
Ciprofloxacin (MIC $\geq$ 0.25)	1% (3)	0.2% (1)	0.3% (1)
Ciprofloxacin (MIC $\geq$ 4)	0% (0)	0% (0)	0.3% (1)
Gentamicin (MIC $\geq$ 16)	0.3% (1)	0.2% (1)	0% (0)
Imipenem (MIC $\geq$ 16)	Not Tested	Not Tested	0% (0)
Kanamycin (MIC $\geq$ 64)	0.5% (2)	1% (6)	1% (2)
Nalidixic Acid (MIC $\geq$ 32)	2% (6)	1% (5)	2% (6)
Streptomycin (MIC $\geq$ 64)	56% (209)	57% (258)	53% (183)
Sulfamethoxazole (MIC $\geq$ 512)	56% (210)	56% (252)	56% (194)
Tetracycline (MIC $\geq$ 16)	57% (215)	45% (202)	59% (204)
Trimeth-Sulfa**** (MIC $\geq$ 4/76)	51% (193)	53% (239)	47% (161)

*Using only antimicrobial agents (n=15) tested in all three years
**ACSuTm=Ampicillin, Chloramphenicol, Sulfamethoxazole-Trimethoprim
***Amox-Clav=Amoxicillin-Clavulanic Acid
****Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

Table 26. Antimicrobial resistance of *Shigella sonnei* isolates, 1999-2001

	1999	2000	2001
Shigella sonnei isolates	275	367	239
Isolates resistant to ≥ 1 antimicrobial agents*	89% (246)	92% (339)	95% (226)
Isolates resistant to ≥ 2 antimicrobial agents*	58% (160)	64% (233)	62% (149)
Shigella sonnei with at least ACSSuT resistance pattern	0.4% (1)	1% (3)	0% (0)
Shigella sonnei with at least ACSuTm** resistance pattern	2% (5)	2% (7)	1% (2)
Amikacin (MIC ≥ 64)	0% (0)	0.3% (1)	0% (0)
Amox-Clav*** (MIC ≥ 32)	0.4% (1)	2% (7)	5% (11)
Ampicillin (MIC ≥ 32)	80% (219)	80% (295)	83% (198)
Apramycin (MIC ≥ 64)	0% (0)	0.3% (1)	0% (0)
Cefoxitin (MIC ≥ 32)	Not Tested	0.5% (2)	2% (4)
Ceftiofur (MIC ≥ 8)	0% (0)	0% (0)	0% (0)
Ceftriaxone (MIC ≥ 64)	0% (0)	0% (0)	0% (0)

*Using only antimicrobial agents (n=15) tested in all three years
**ACSuTm=Ampicillin, Chloramphenicol, Sulfamethoxazole-Trimethoprim
***Amox-Clav=Amoxicillin-Clavulanic Acid
****Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 26. Summary: Antimicrobial resistance of *Shigella sonnei* isolates, 1999-2001

	1999	2000	2001
Cephalothin (MIC ≥ 32)	3% (8)	9% (32)	12% (30)
Chloramphenicol (MIC ≥ 32)	2% (5)	3% (10)	1% (3)
Ciprofloxacin (MIC ≥ 0.25)	1% (2)	0.3% (1)	0% (0)
Ciprofloxacin (MIC ≥ 4)	0% (0)	0% (0)	0% (0)
Gentamicin (MIC ≥ 16)	0.4% (1)	0.3% (1)	0% (0)
Imipenem (MIC ≥ 16)	Not Tested	Not Tested	0% (0)
Kanamycin (MIC ≥ 64)	1% (2)	2% (6)	0.4% (1)
Nalidixic Acid (MIC ≥ 32)	1% (4)	1% (5)	1% (2)
Streptomycin (MIC ≥ 64)	52% (143)	56% (206)	54% (129)
Sulfamethoxazole (MIC ≥ 512)	54% (150)	56% (206)	54% (130)
Tetracycline (MIC ≥ 16)	46% (127)	34% (126)	45% (107)
Trimeth-Sulfa**** (MIC ≥ 4/76)	53% (146)	55% (202)	51% (121)

*Using only antimicrobial agents (n=15) tested in all three years
**ACSuTm=Ampicillin, Chloramphenicol, Sulfamethoxazole-Trimethoprim
***Amox-Clav=Amoxicillin-Clavulanic Acid
****Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

Table 27. Antimicrobial resistance of *Shigella flexneri* isolates, 1999-2001

	1999	2000	2001
Shigella flexneri isolates	87	75	91
Isolates resistant to ≥ 1 antimicrobial agents*	95% (83)	96% (72)	97% (88)
Isolates resistant to ≥ 2 antimicrobial agents*	84% (73)	83% (62)	90% (82)
Shigella flexneri with at least ACSSuT resistance pattern	33% (29)	29% (22)	22% (20)
Shigella flexneri with at least ACSuTm** resistance pattern	34% (30)	32% (24)	23% (21)
Amikacin (MIC ≥ 64)	0% (0)	0% (0)	0% (0)
Amox-Clav*** (MIC ≥ 32)	3% (3)	4% (3)	4% (4)
Ampicillin (MIC ≥ 32)	77% (67)	77% (58)	72% (66)
Apramycin (MIC ≥ 64)	0% (0)	0% (0)	0% (0)
Cefoxitin (MIC ≥ 32)	Not Tested	0% (0)	0% (0)
Ceftiofur (MIC ≥ 8)	0% (0)	0% (0)	0% (0)
Ceftriaxone (MIC ≥ 64)	0% (0)	0% (0)	0% (0)

*Using only antimicrobial agents (n=15) tested in all three years
**ACSuTm=Ampicillin, Chloramphenicol, Sulfamethoxazole-Trimethoprim
***Amox-Clav=Amoxicillin-Clavulanic Acid
****Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Table 27. Summary: Antimicrobial resistance of *Shigella flexneri* isolates, 1999-2001

	1999	2000	2001
Cephalothin (MIC ≥ 32)	5% (4)	3% (2)	1% (1)
Chloramphenicol (MIC ≥ 32)	64% (56)	69% (52)	75% (68)
Ciprofloxacin (MIC ≥ 0.25)	1% (1)	0% (0)	1% (1)
Ciprofloxacin (MIC ≥ 4)	0% (0)	0% (0)	1% (1)
Gentamicin (MIC ≥ 16)	0% (0)	0% (0)	0% (0)
Imipenem (MIC ≥ 16)	Not Tested	Not Tested	0% (0)
Kanamycin (MIC ≥ 64)	0% (0)	0% (0)	1% (1)
Nalidixic Acid (MIC ≥ 32)	1% (1)	0% (0)	3% (3)
Streptomycin (MIC ≥ 64)	63% (55)	61% (46)	47% (43)
Sulfamethoxazole (MIC ≥ 512)	59% (51)	53% (40)	57% (52)
Tetracycline (MIC ≥ 16)	92% (80)	92% (69)	94% (86)
Trimeth-Sulfa**** (MIC ≥ 4/76)	48% (42)	43% (32)	34% (31)

*Using only antimicrobial agents (n=15) tested in all three years
**ACSuTm=Ampicillin, Chloramphenicol, Sulfamethoxazole-Trimethoprim
***Amox-Clav=Amoxicillin-Clavulanic Acid
****Trimeth-Sulfa=Trimethoprim-Sulfamethoxazole

Table 28. Frequency of *Campylobacter* species, 2001

Species	**N**	**%**
jejuni	365	95
coli	17	4
fetus	1	0.3
Other species	1	0.3
Total	**384**	**100**

Table 29. Antimicrobial resistance of *Campylobacter* isolates, by *Campylobacter* species, 2001

Antimicrobial Agent	All *Campylobacter* (N=384)		*Campylobacter jejuni* (N=365)		*Campylobacter coli* (N=17)	
	# Resistant	% Resistant	# Resistant	% Resistant	# Resistant	% Resistant
Azithromycin	8	2	7	2	1	6
Chloramphenicol	0	0	0	0	0	0
Ciprofloxacin	75	19	67	18	8	47
Clindamycin	8	2	7	2	1	6
Erythromycin	8	2	7	2	1	6
Gentamicin	0	0	0	0	0	0
Nalidixic Acid	77	20	69	19	7	41
Tetracycline	156	41	146	40	10	59

Table 30. Antimicrobial resistance of *Campylobacter jejuni* isolates, by site, 2001

Site	Antimicrobial Agent	*Campylobacter jejuni* (N=365)	
		#Resistant	% Resistant within state
California (N=46)	Azithromycin	0	0
	Chloramphenicol	0	0
	Ciprofloxacin	11	24
	Clindamycin	0	0
	Erythromycin	0	0
	Gentamicin	0	0
	Nalidixic Acid	11	24
	Tetracycline	17	37
Colorado (N=40)	Azithromycin	0	0
	Chloramphenicol	0	0
	Ciprofloxacin	4	10
	Clindamycin	0	0
	Erythromycin	0	0
	Gentamicin	0	0
	Nalidixic Acid	4	10
	Tetracycline	13	32
Connecticut (N=43)	Azithromycin	0	0
	Chloramphenicol	0	0
	Ciprofloxacin	12	28
	Clindamycin	0	0
	Erythromycin	0	0
	Gentamicin	0	0
	Nalidixic Acid	12	28
	Tetracycline	27	63

Table 30. Antimicrobial resistance of *Campylobacter jejuni* isolates, by site, 2001

Site	Antimicrobial Agent	*Campylobacter jejuni* (N=365)	
		#Resistant	% Resistant within state
Georgia (N=52)	Azithromycin	2	4
	Chloramphenicol	0	0
	Ciprofloxacin	14	27
	Clindamycin	2	4
	Erythromycin	2	4
	Gentamicin	0	0
	Nalidixic Acid	14	27
	Tetracycline	18	35
Maryland (N=36)	Azithromycin	0	0
	Chloramphenicol	0	0
	Ciprofloxacin	7	19
	Clindamycin	0	0
	Erythromycin	0	0
	Gentamicin	0	0
	Nalidixic Acid	7	19
	Tetracycline	9	25
Minnesota (N=47)	Azithromycin	2	4
	Chloramphenicol	0	0
	Ciprofloxacin	7	15
	Clindamycin	2	4
	Erythromycin	2	4
	Gentamicin	0	0
	Nalidixic Acid	8	17
	Tetracycline	27	57

Table 30. Antimicrobial resistance of *Campylobacter jejuni* isolates, by site, 2001

Site	Antimicrobial Agent	*Campylobacter jejuni* (N=365)	
		#Resistant	% Resistant within state
New York State (N=44)	Azithromycin	1	2
	Chloramphenicol	0	0
	Ciprofloxacin	5	11
	Clindamycin	1	2
	Erythromycin	1	2
	Gentamicin	0	0
	Nalidixic Acid	5	11
	Tetracycline	18	41
Oregon (N=26)	Azithromycin	0	0
	Chloramphenicol	0	0
	Ciprofloxacin	2	8
	Clindamycin	0	0
	Erythromycin	0	0
	Gentamicin	0	0
	Nalidixic Acid	3	11
	Tetracycline	6	23
Tennessee (N=31)	Azithromycin	2	6
	Chloramphenicol	0	0
	Ciprofloxacin	5	16
	Clindamycin	2	6
	Erythromycin	2	6
	Gentamicin	0	0
	Nalidixic Acid	5	16
	Tetracycline	11	35

Table 31. Antimicrobial resistance of *Campylobacter* isolates, 1997-2001

Campylobacter	1997	1998	1999	2000	2001
Campylobacter isolates	217	310	318	324	384
Isolates resistant to ≥ 1 antimicrobial agents*	52% (113)	55% (170)	53% (169)	48% (155)	50% (193)
Isolates resistant to ≥ 2 antimicrobial agents*	16% (34)	18% (57)	21% (67)	16% (51)	21% (81)
Ciprofloxacin (MIC ≥ 4)	13% (28)	13% (42)	18% (58)	14% (46)	19% (75)
Nalidixic Acid (MIC ≥ 32)	14% (31)	17% (54)	21% (67)	17% (54)	20% (77)
Erythromycin (MIC ≥ 8)	2% (4)	3% (8)	2% (8)	1% (5)	2% (8)
Azithromycin (MIC ≥ 2)	Not Tested	2% (5)	3% (10)	2% (7)	2% (8)
Chloramphenicol (MIC ≥ 32)	1% (3)	2% (6)	0.3% (1)	0% (0)	0% (0)
Clindamycin (MIC ≥ 4)	2% (4)	1% (4)	2% (5)	1% (4)	2% (8)
Gentamicin (MIC ≥ 16)	Not Tested	0% (0)	0% (0)	0.3% (1)	0% (0)
Tetracycline (MIC ≥ 16)	47% (102)	45% (141)	44% (140)	38% (122)	41% (156)

*Using only *Campylobacter* antimicrobial agents (n=6) tested in all five years

Table 32. Antimicrobial resistance of *Campylobacter jejuni* isolates, 1997-2001

Campylobacter jejuni	1997	1998	1999	2000	2001
Campylobacter jejuni isolates	209	297	294	306	365
Isolates resistant to ≥ 1 antimicrobial agents*	51% (107)	54% (162)	53% (157)	49% (149)	50% (181)
Isolates resistant to ≥ 2 antimicrobial agents*	14% (30)	17% (50)	19% (57)	15% (45)	20% (73)
Ciprofloxacin (MIC ≥ 4)	12% (26)	14% (41)	18% (52)	14% (43)	18% (67)
Nalidixic Acid (MIC ≥ 32)	13% (28)	16% (47)	20% (59)	16% (49)	19% (69)
Erythromycin (MIC ≥ 8)	1% (3)	2% (7)	2% (6)	1% (4)	2% (7)
Azithromycin (MIC ≥ 2)	Not Tested	1% (4)	3% (8)	2% (6)	2% (7)
Chloramphenicol (MIC ≥ 32)	1% (2)	1% (2)	0.3% (1)	0% (0)	0% (0)
Clindamycin (MIC ≥ 4)	1% (2)	1% (3)	1% (3)	1% (3)	2% (7)
Gentamicin (MIC ≥ 16)	Not Tested	0% (0)	0% (0)	0% (0)	0% (0)
Tetracycline (MIC ≥ 16)	47% (98)	46% (137)	46% (134)	39% (118)	40% (146)

*Using only *Campylobacter* antimicrobial agents (n=6) tested in all five years

Table 33. Antimicrobial resistance of *Campylobacter coli* isolates, 1997-2001

Campylobacter coli	1997	1998	1999	2000	2001
Campylobacter coli isolates	6	8	20	12	17
Isolates resistant to ≥ 1 antimicrobial agents*	83% (5)	50% (4)	50% (10)	33% (4)	65% (11)
Isolates resistant to ≥ 2 antimicrobial agents*	50% (3)	50% (4)	35% (7)	25% (3)	47% (8)
Ciprofloxacin (MIC ≥ 4)	33% (2)	0% (0)	30% (6)	25% (3)	47% (8)
Nalidixic Acid (MIC ≥ 32)	50% (3)	50% (4)	30% (6)	25% (3)	41% (7)
Erythromycin (MIC ≥ 8)	0% (0)	12% (1)	10% (2)	8% (1)	6% (1)
Azithromycin (MIC ≥ 2)	Not Tested	12% (1)	10% (2)	8% (1)	6% (1)
Chloramphenicol (MIC ≥ 32)	17% (1)	25% (2)	0% (0)	0% (0)	0% (0)
Clindamycin (MIC ≥ 4)	17% (1)	12% (1)	10% (2)	8% (1)	6% (1)
Gentamicin (MIC ≥ 16)	Not Tested	0% (0)	0% (0)	8% (1)	0% (0)
Tetracycline (MIC ≥ 16)	67% (4)	50% (4)	30% (6)	25% (3)	59% (10)

*Using only *Campylobacter* antimicrobial agents (n=6) tested in all five years

Table 34. Frequency of resistance and multidrug* resistance among *Salmonella* Typhi, *Shigella, E. coli* O157, and *Campylobacter* isolates, 2001

Isolate	Total		Number resistant to ≥ 1 antimicrobial agents		Number resistant to ≥ 2 antimicrobial agents		Number resistant to ≥ 5 antimicrobial agents		Number resistant to ≥ 8 antimicrobial agents	
	N	%	N	%	N	%	N	%	N	%
Salmonella Typhi	197	100	81	41	46	23	38	19	0	0
Shigella	344	100	327	95	244	71	125	36	1	0.3
sonnei	239	69	226	95	149	62	86	36	0	0
flexneri	91	26	88	97	82	90	30	33	1	1
E. coli O157	277	100	24	9	15	5	4	1	1	0.4
Campylobacter	384	100	193	50	81	21	3	1	0	0
jejuni	365	95	181	50	73	20	3	1	0	0
coli	17	4	11	65	8	47	0	0	0	0

*Multidrug resistance for *Salmonella*, *Shigella*, *E. coli* O157 to 18 antimicrobial agents tested in 2001: amikacin, amoxicillin-clavulanic acid, ampicillin, apramycin, cefoxitin, ceftiofur, ceftriaxone, cephalothin, chloramphenicol, ciprofloxacin, gentamicin, imipenem, kanamycin, nalidixic acid, streptomycin, sulfamethoxazole, tetracycline, trimethoprim-sulfamethoxazole; Multidrug resistance for *Campylobacter* to 8 antimicrobial agents tested in 2001: azithromycin, chloramphenicol, ciprofloxacin, clindamycin, erythromycin, gentamicin, naladixic acid, tetracycline

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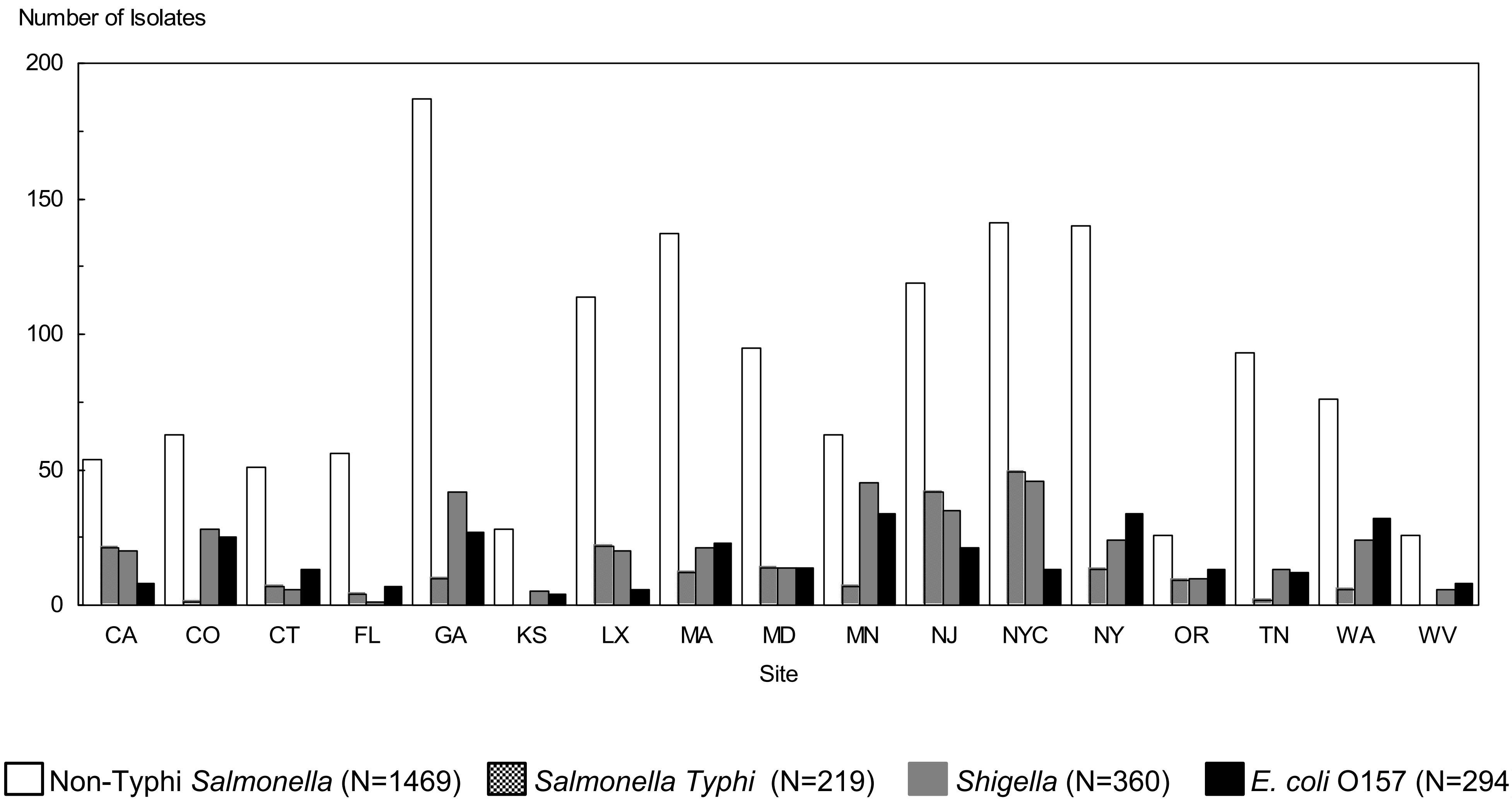
Figure 1. Number of isolates submitted, by site, 2001



CA=Alameda, Contra Costa, and San Francisco counties
LX=Los Angeles County
NY=excluding New York City
NYC=New York City

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Figure 2a. MICs for amikacin among non-Typhi *Salmonella* isolates, 1996-2001

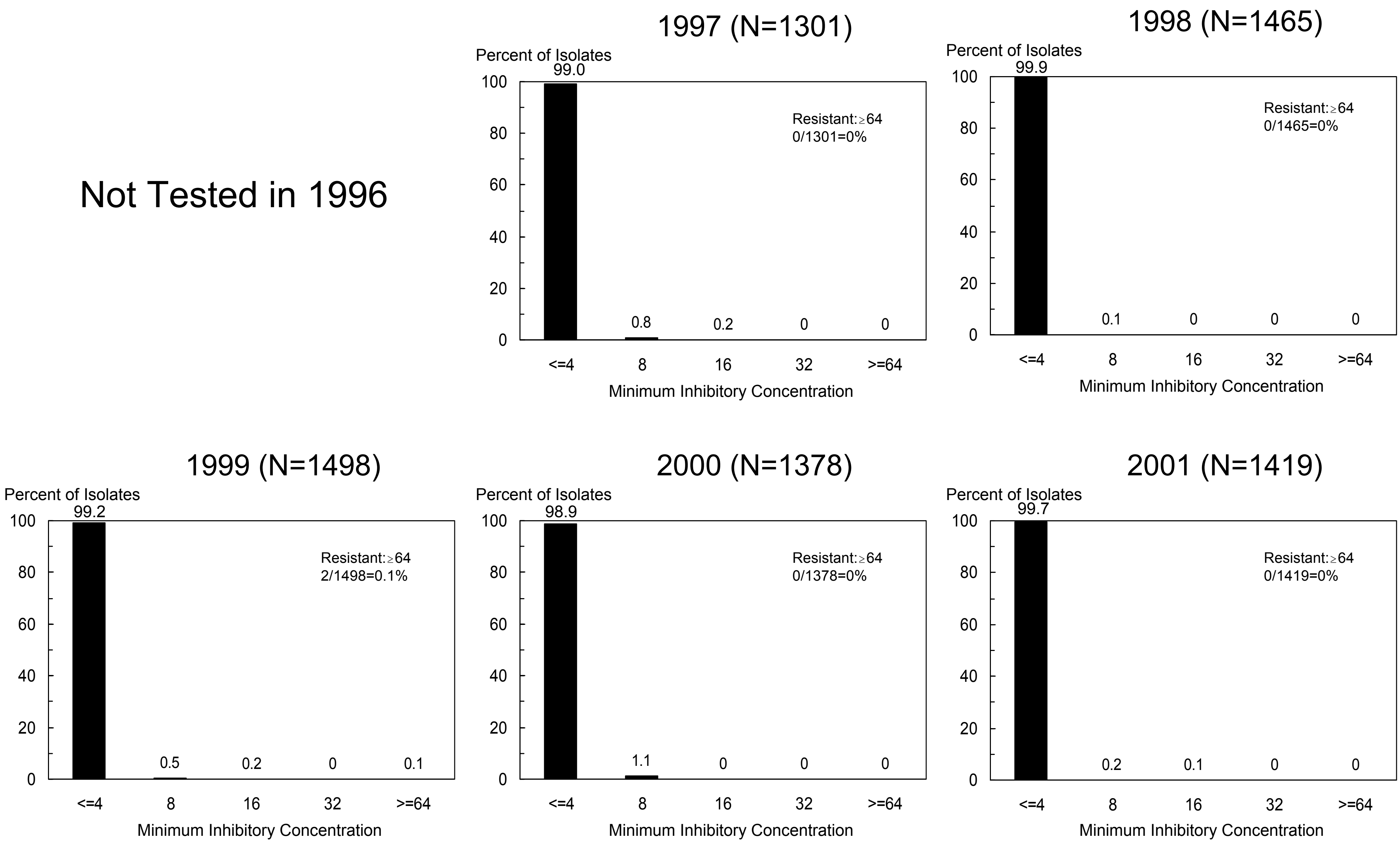

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Figure 2b. MICs for amoxicillin-clavulanic acid among non-Typhi *Salmonella* isolates, 1996-2001

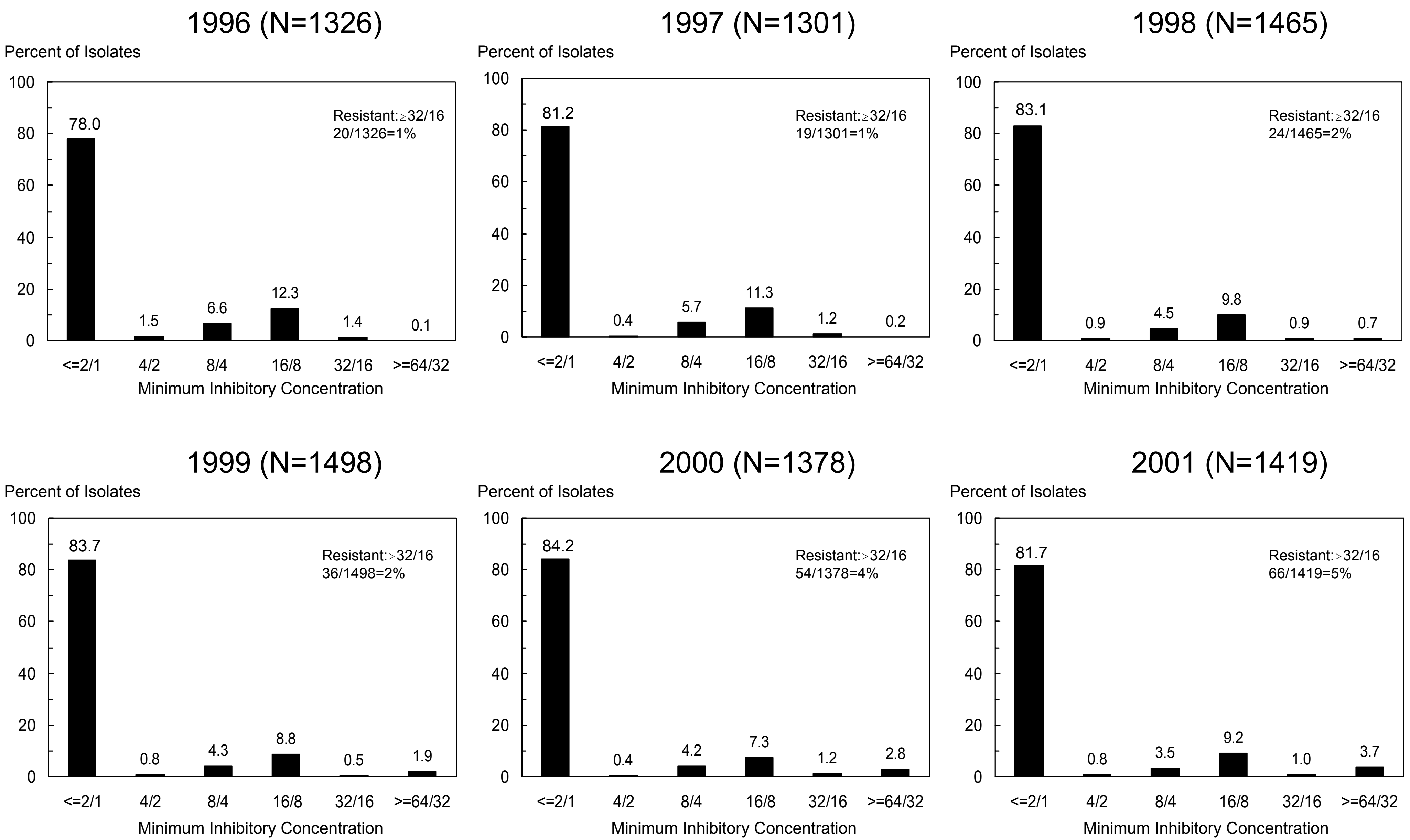

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Figure 2c. MICs for ampicillin among non-Typhi *Salmonella* isolates, 1996-2001

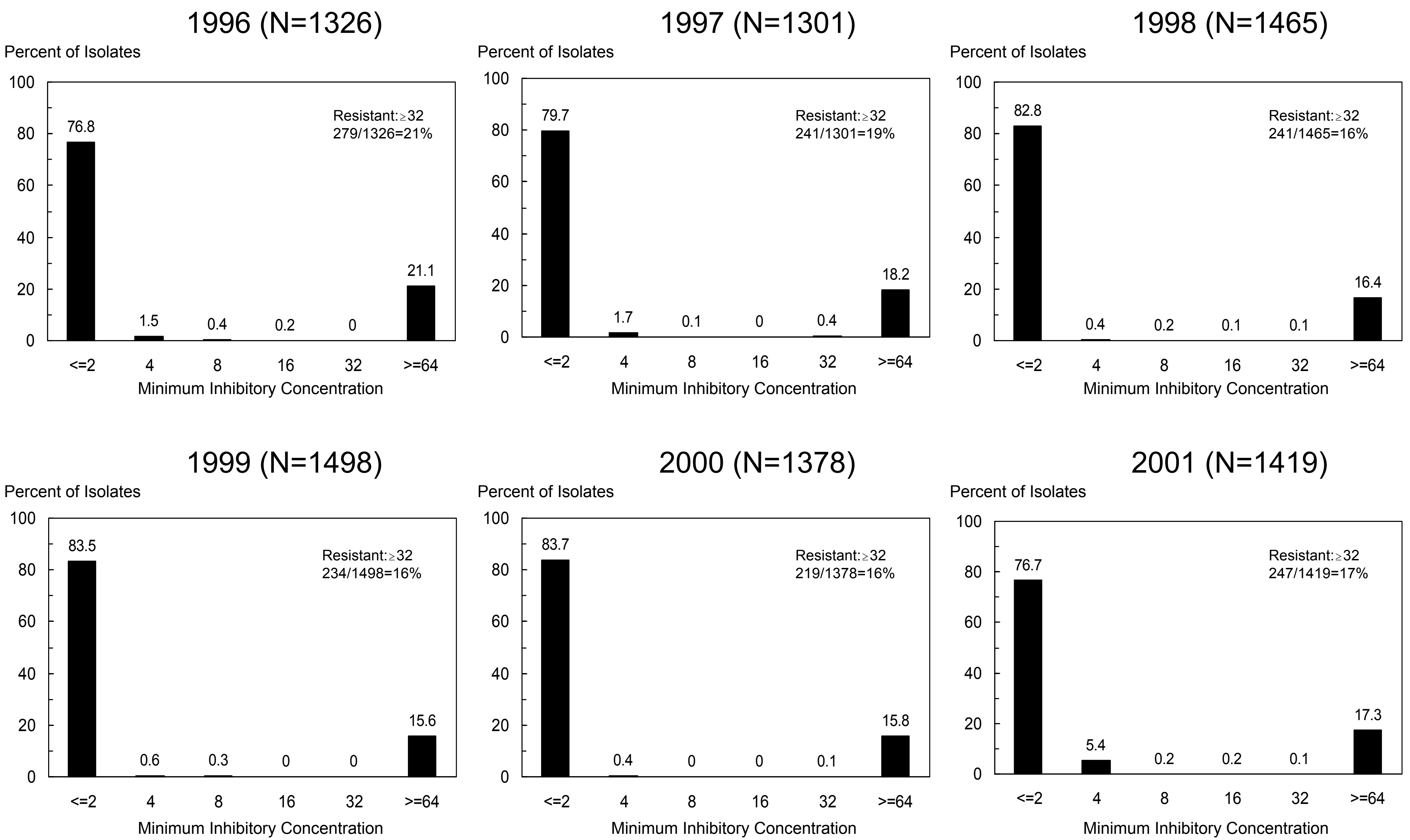

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Figure 2d. MICs for apramycin among non-Typhi *Salmonella* isolates, 1996-2001

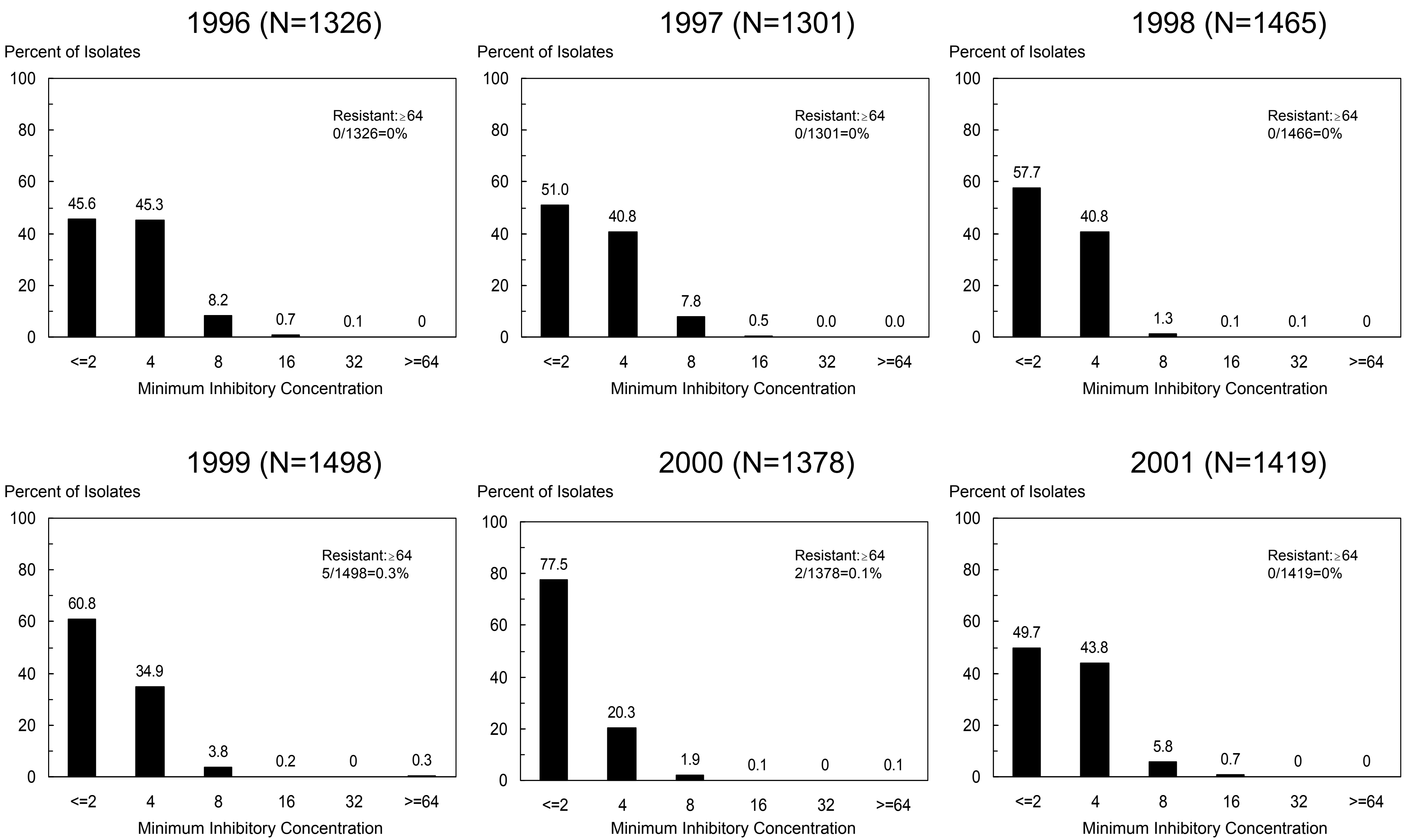

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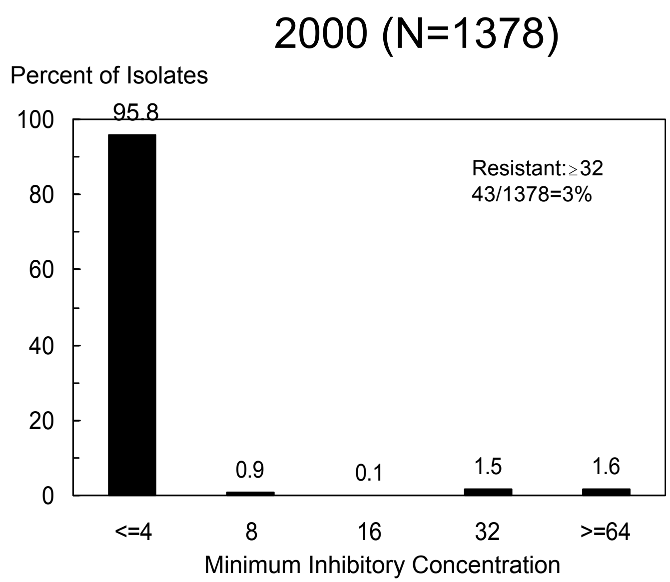
Figure 2e. MICs for cefoxitin among non-Typhi *Salmonella* isolates, 1996-2001

Not Tested in 1996 - 1999



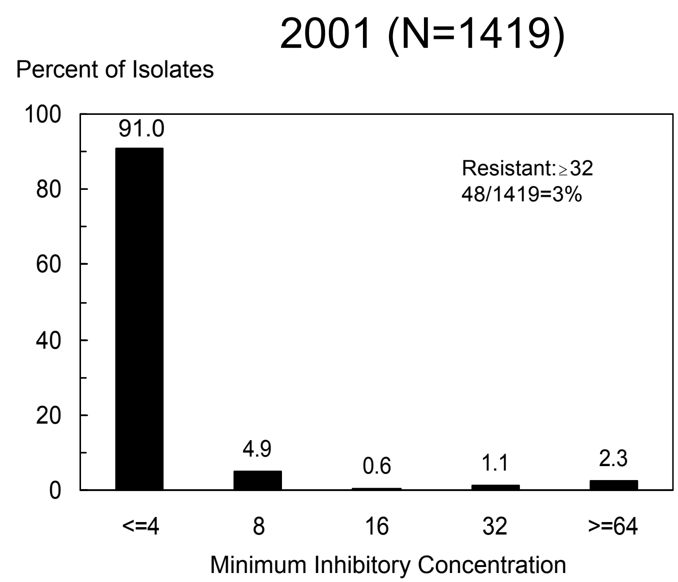


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Figure 2f. MICs for ceftiofur among non-Typhi *Salmonella* isolates, 1996-2001

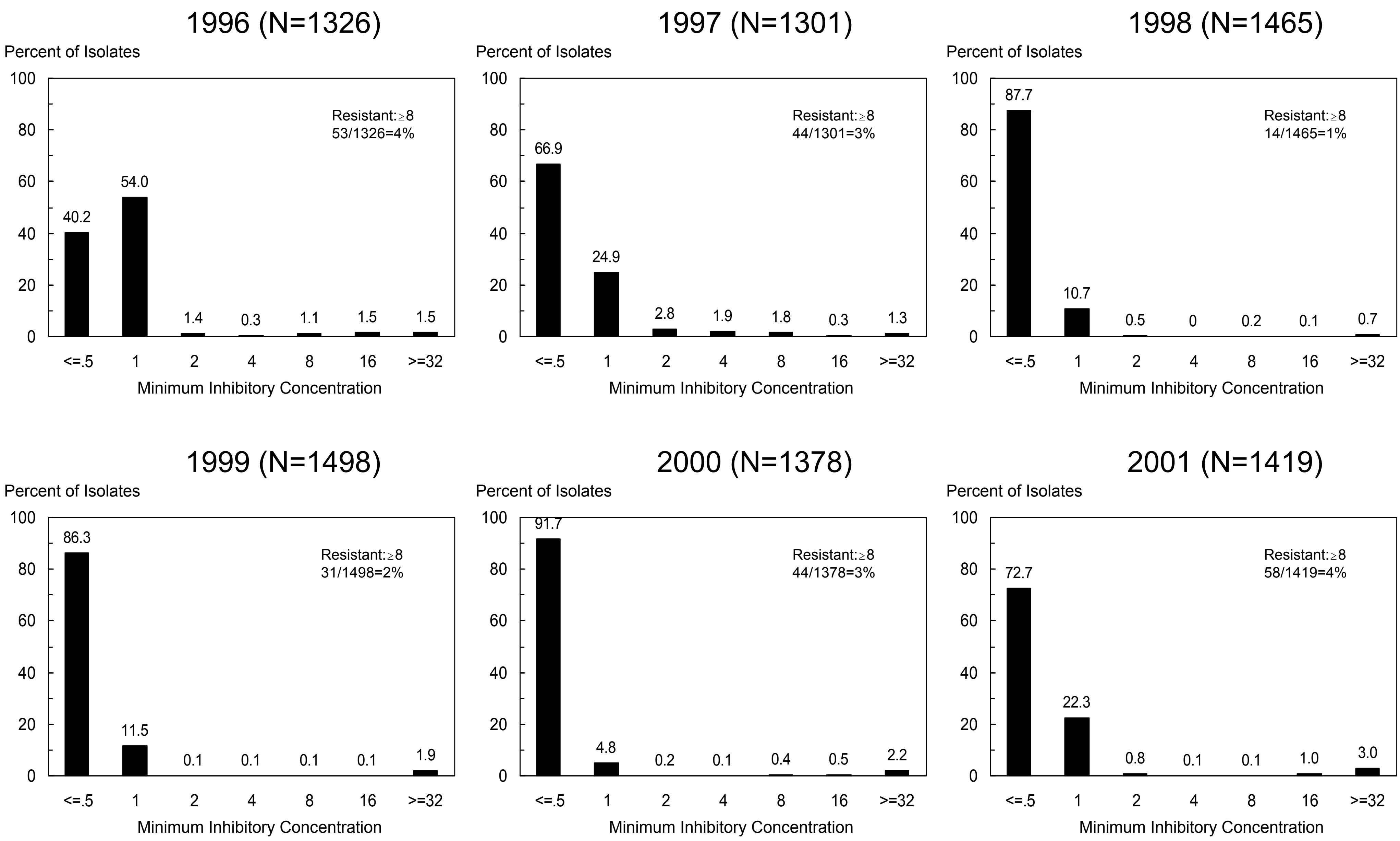

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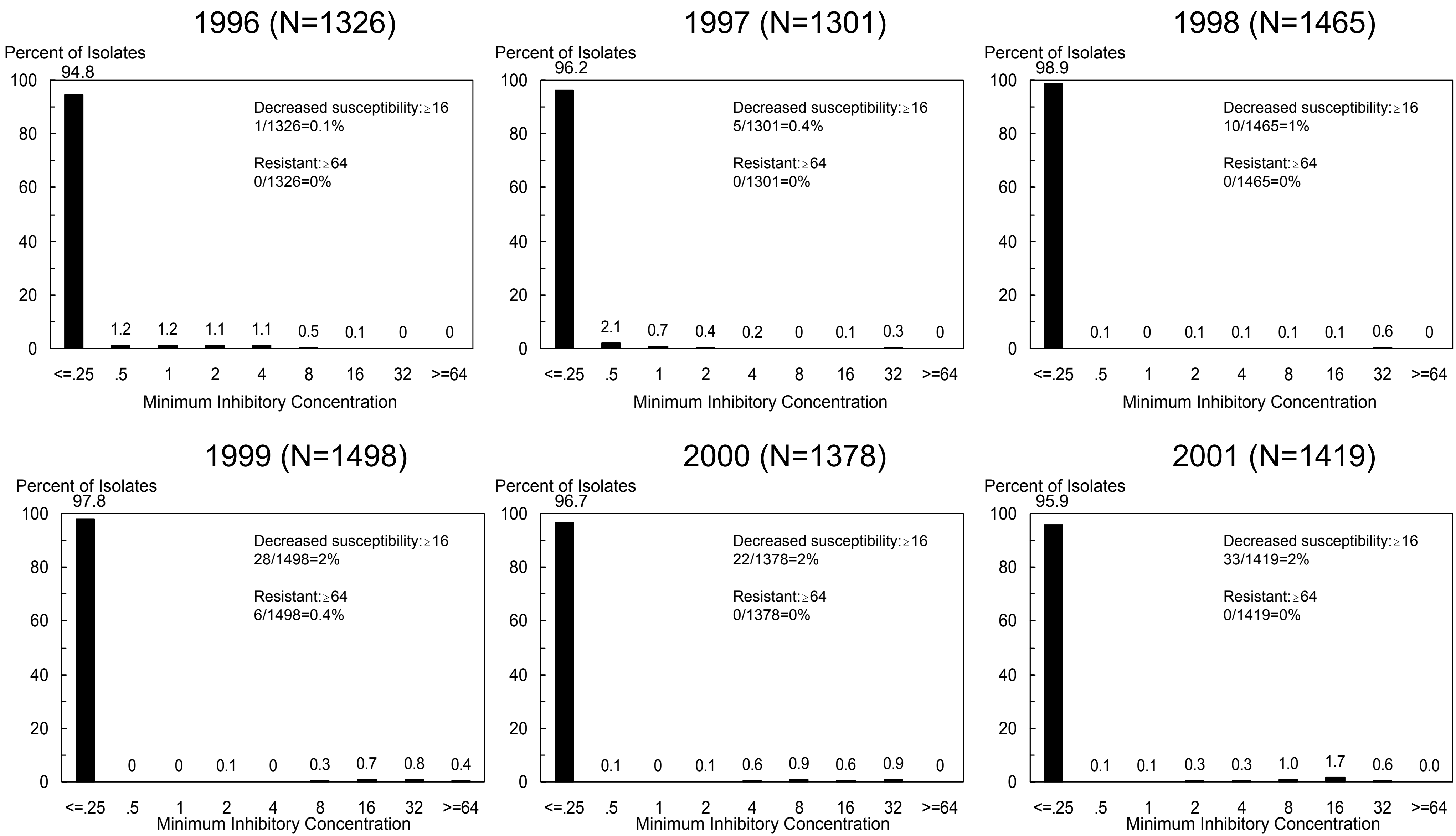
Figure 2g. MICs for ceftriaxone* among non-Typhi *Salmonella* isolates, 1996-2001



* Sensititre® results only

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Figure 2h. MICs for cephalothin among non-Typhi *Salmonella* isolates, 1996-2001

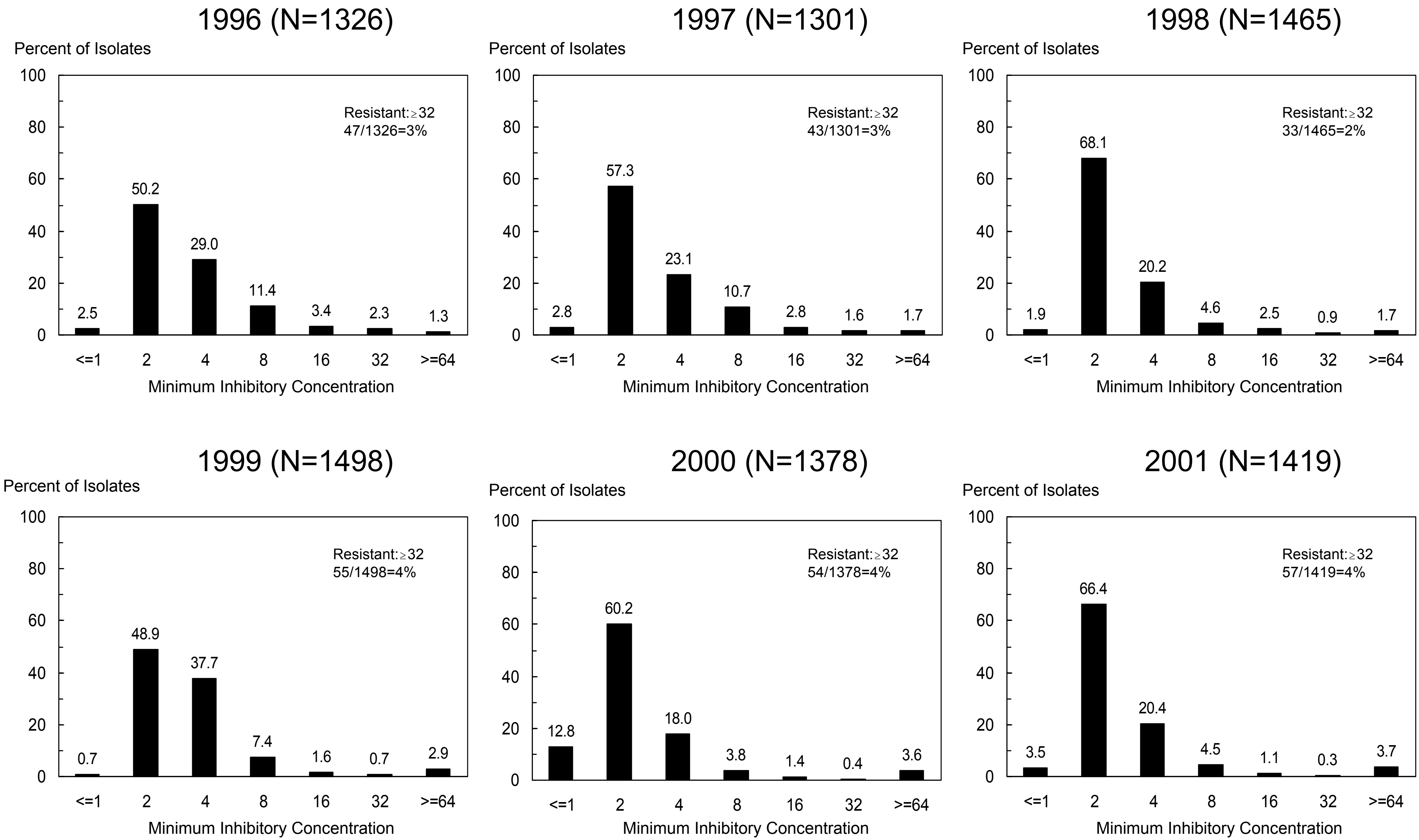

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Figure 2i. MICs for chloramphenicol among non-Typhi *Salmonella* isolates, 1996-2001

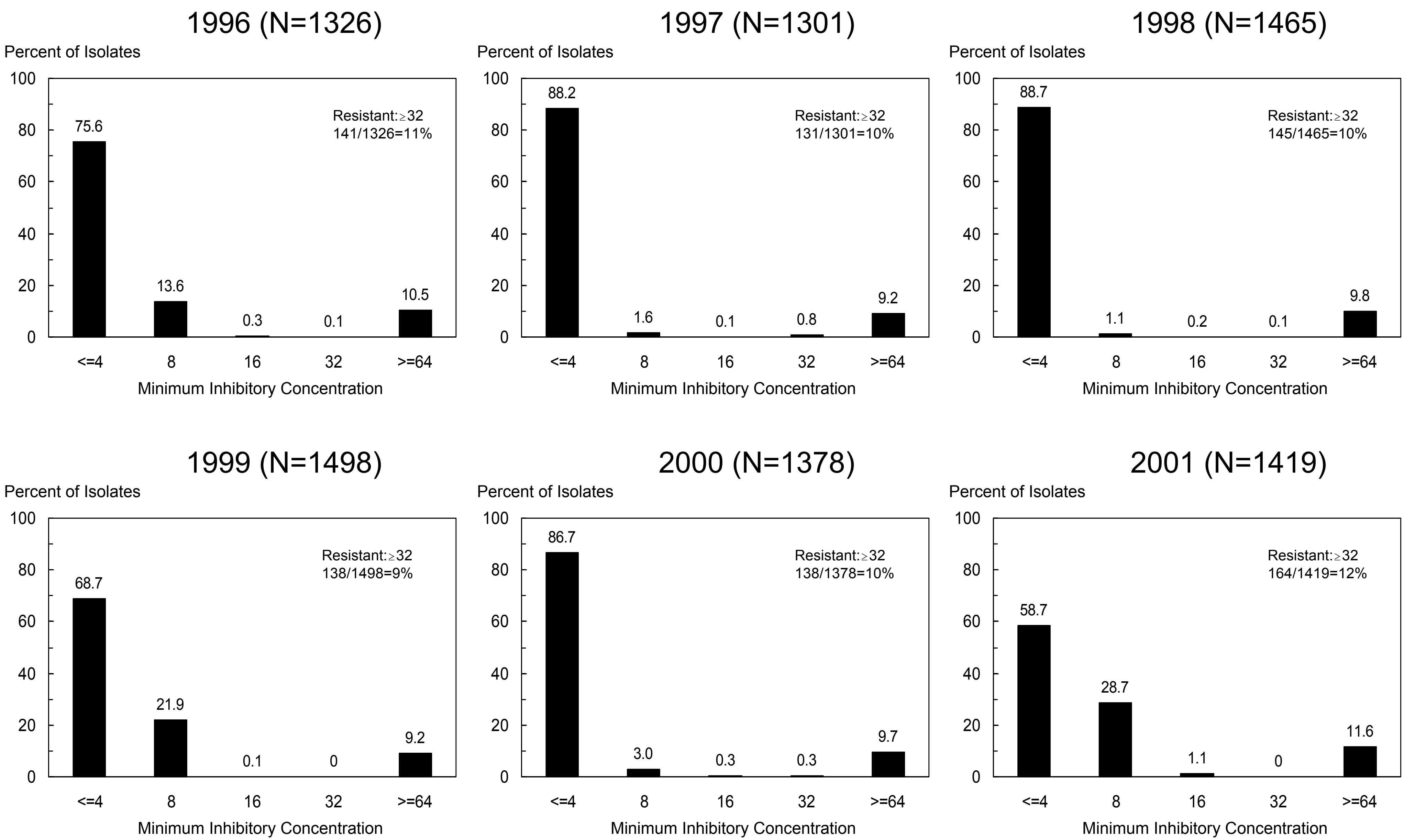

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Figure 2j. MICs for ciprofloxacin among non-Typhi *Salmonella* isolates, 1996-2001

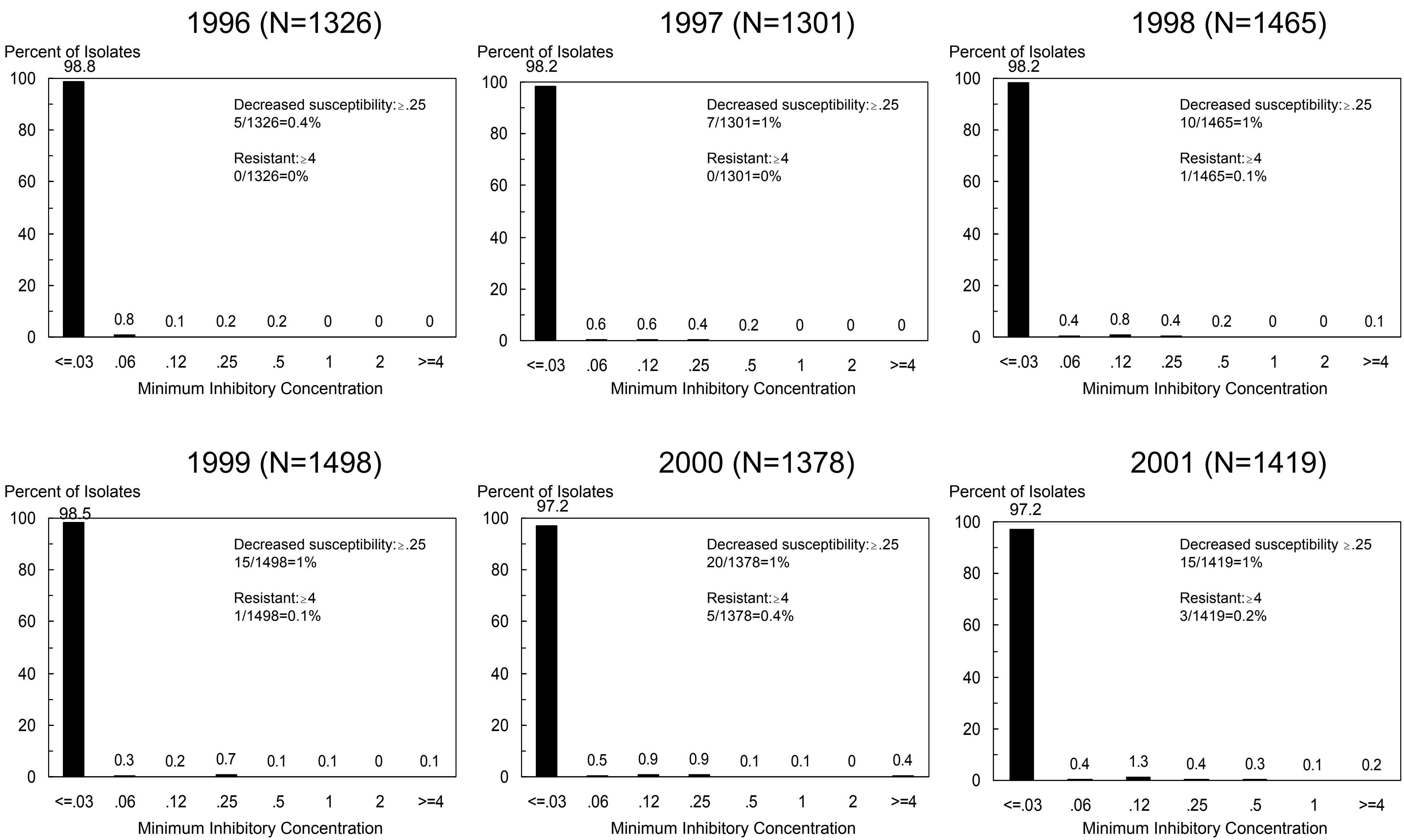

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Figure 2k. MICs for gentamicin among non-Typhi *Salmonella* isolates, 1996-2001

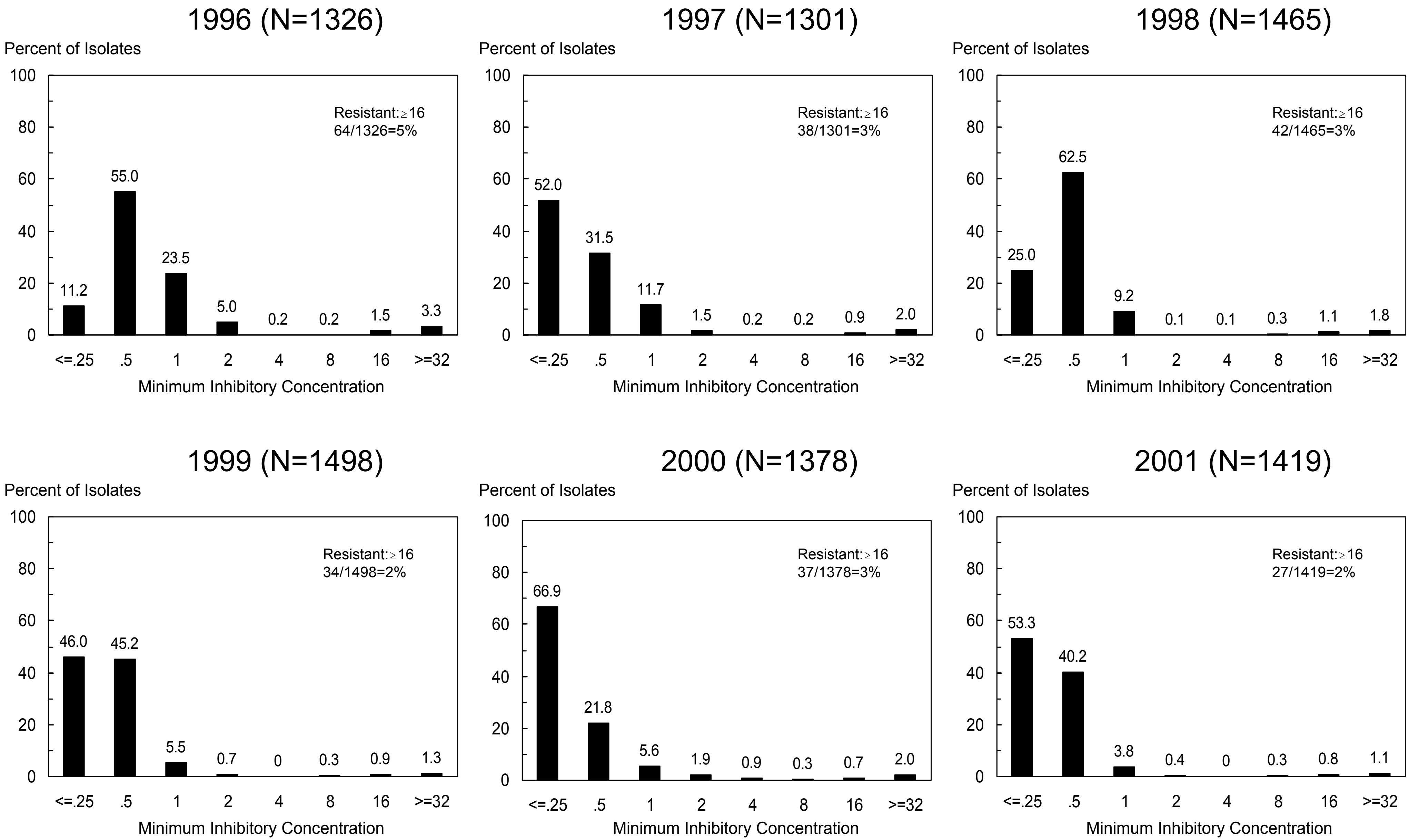

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Figure 2I. MICs for kanamycin among non-Typhi *Salmonella* isolates, 1996-2001

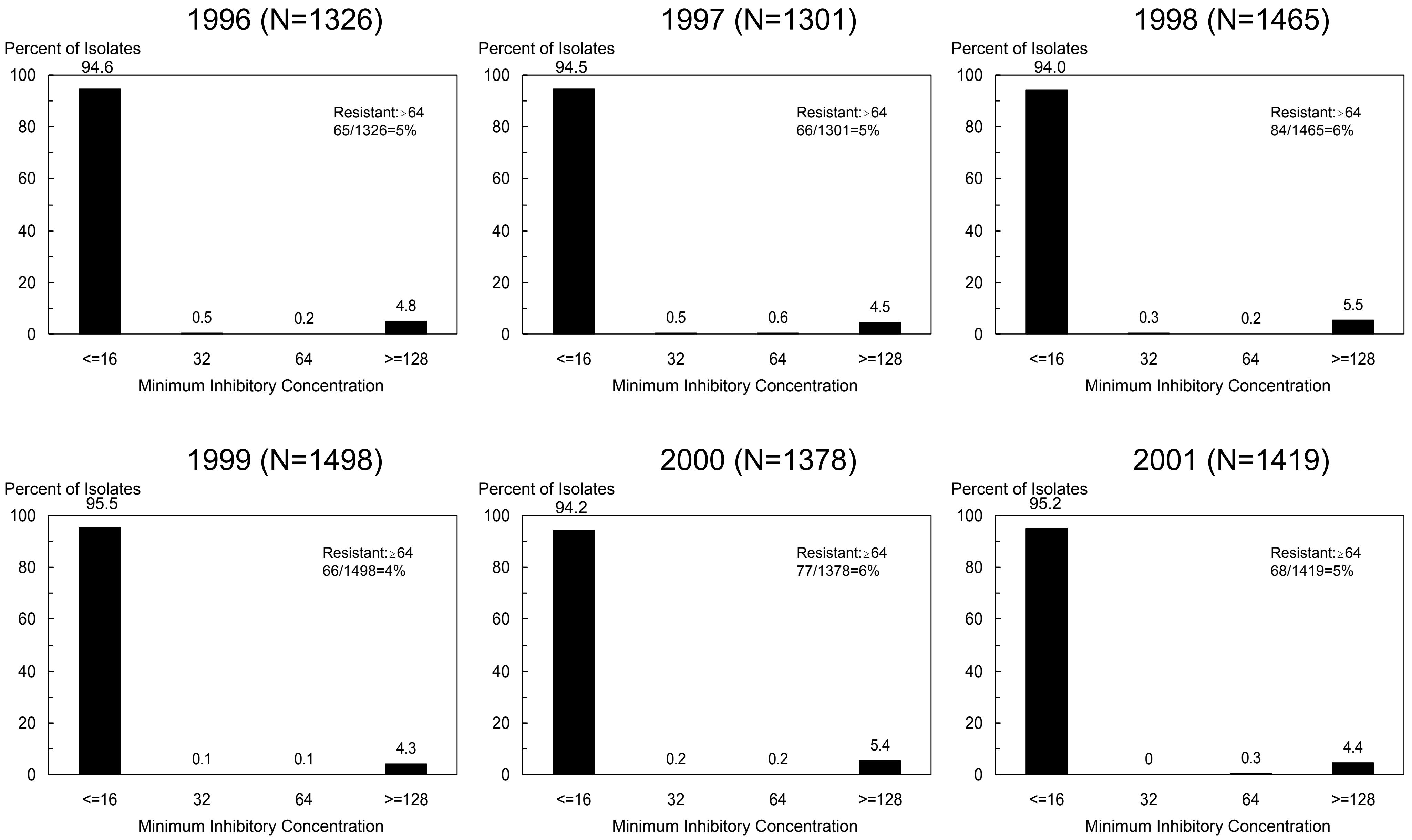

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Figure 2m. MICs for nalidixic acid among non-Typhi *Salmonella* isolates, 1996-2001

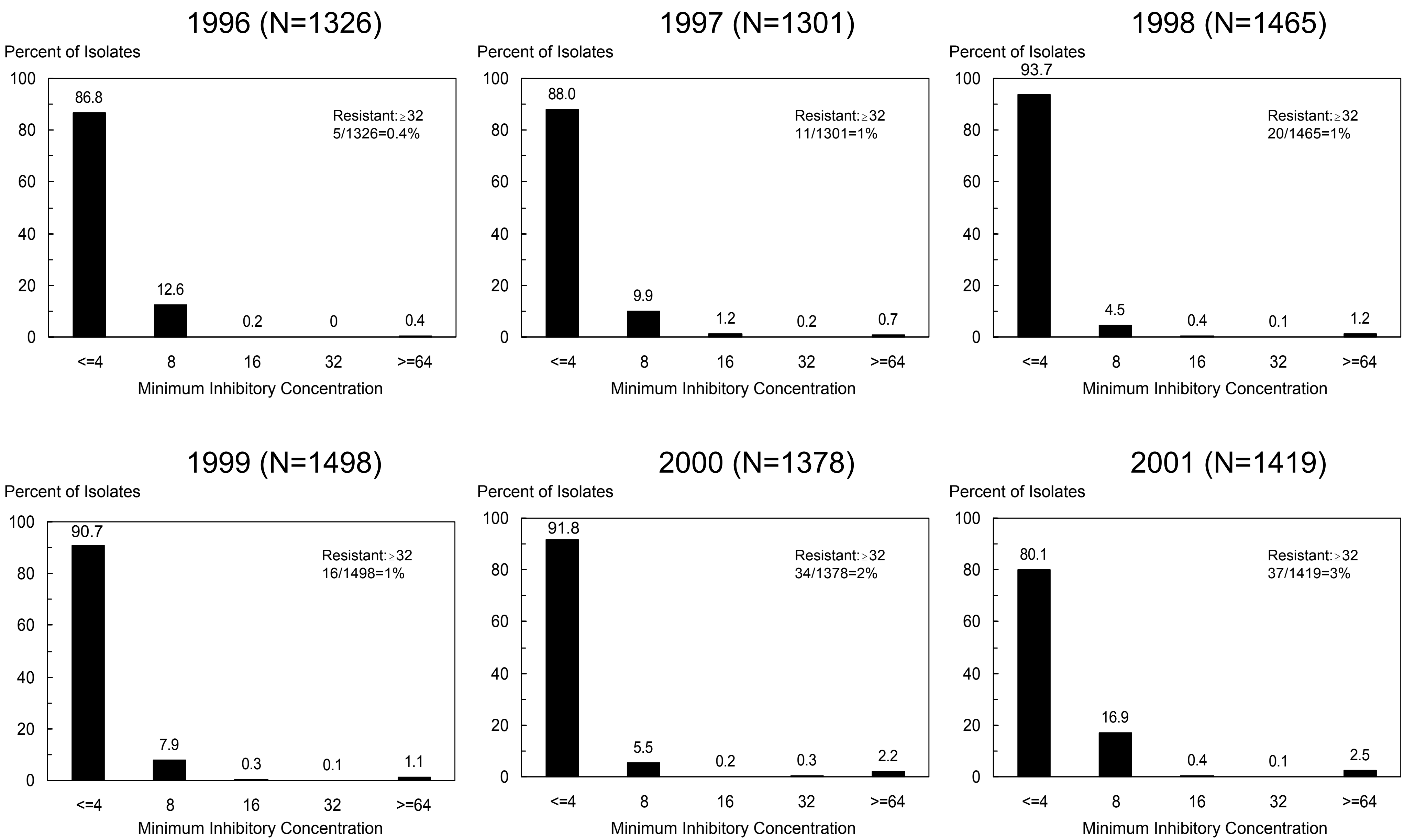

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Figure 2n. MICs for streptomycin among non-Typhi *Salmonella* isolates, 1996-2001

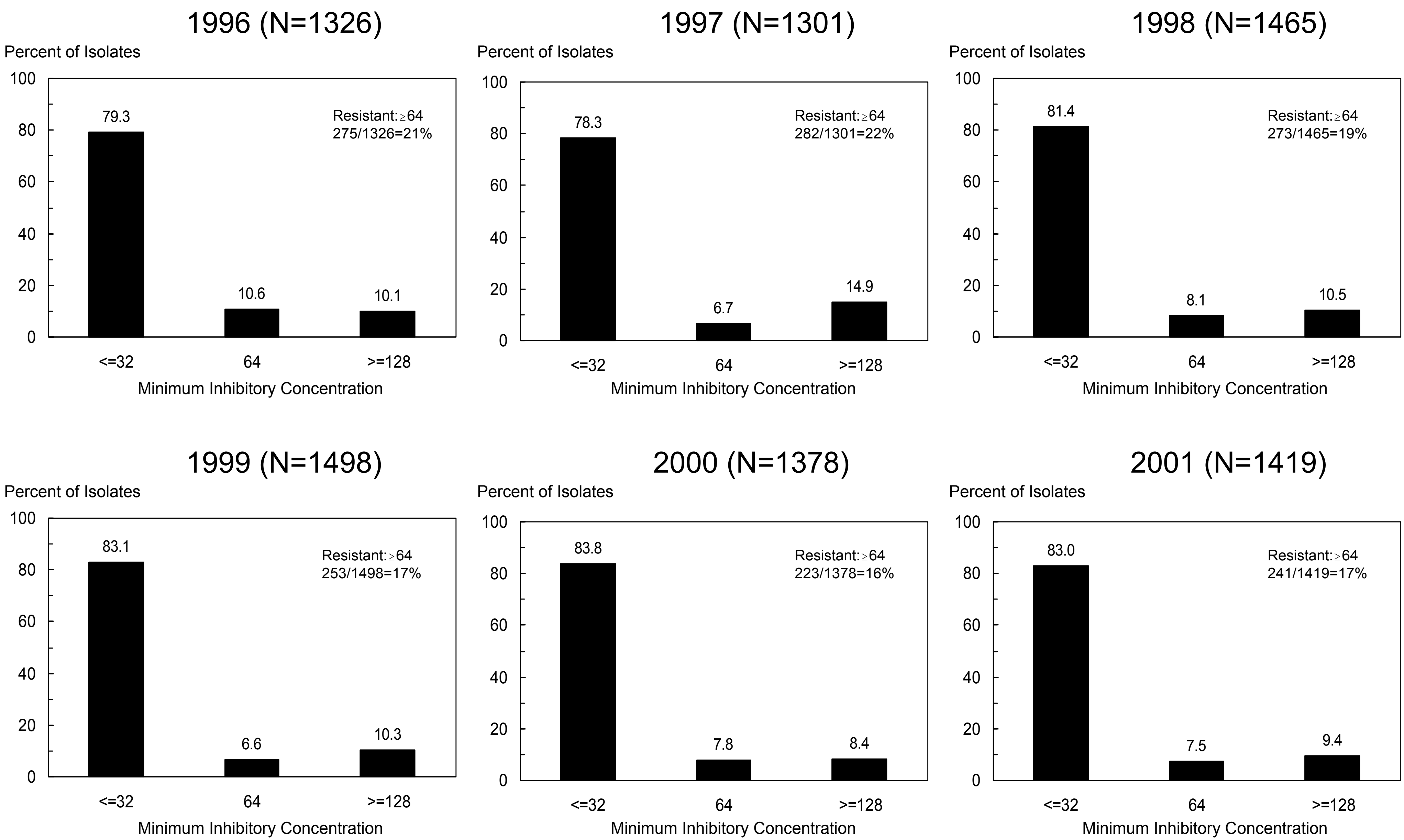

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Figure 2o. MICs for sulfamethoxazole among non-Typhi *Salmonella* isolates, 1996-2001

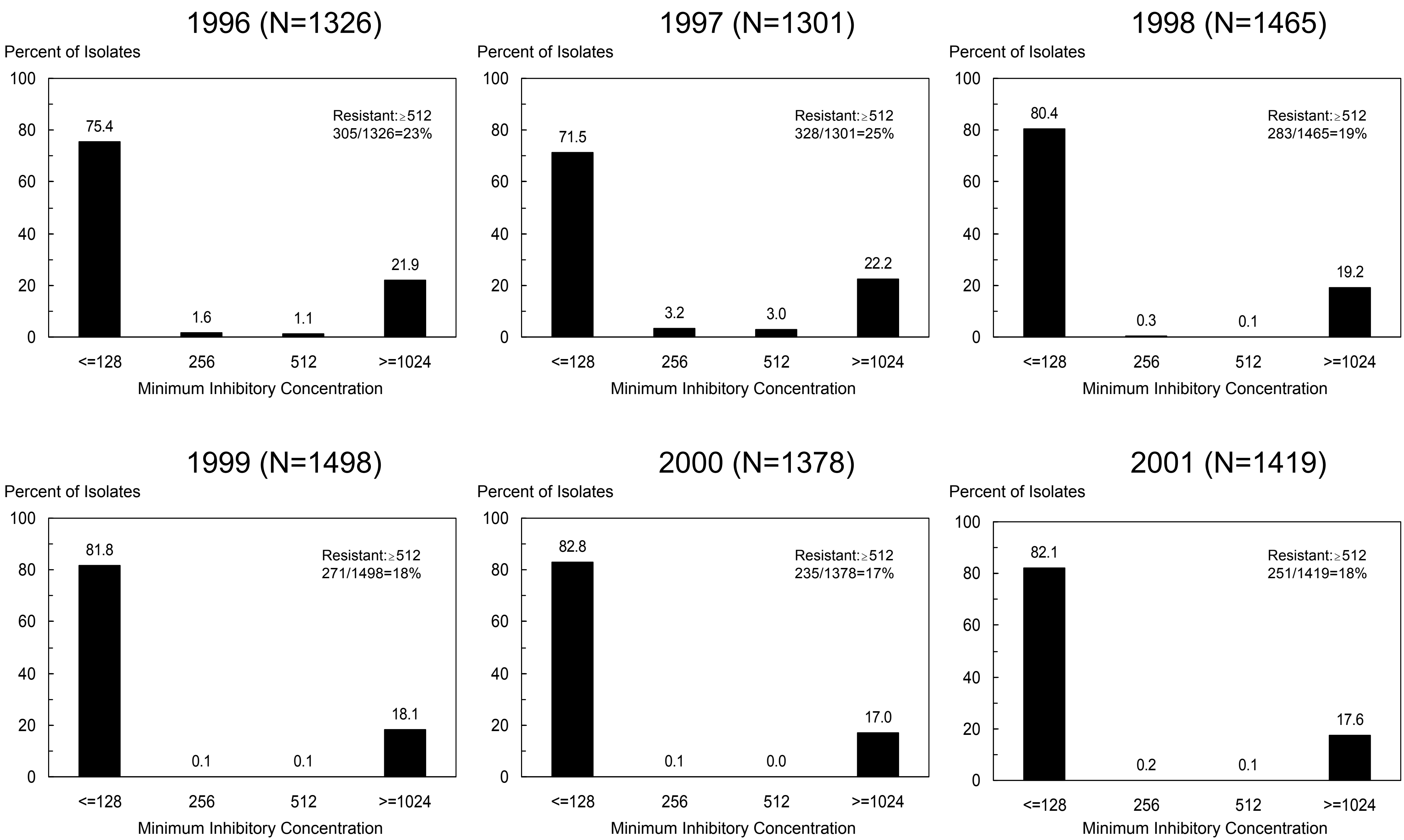

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Figure 2p. MICs for tetracycline among non-Typhi *Salmonella* isolates, 1996-2001

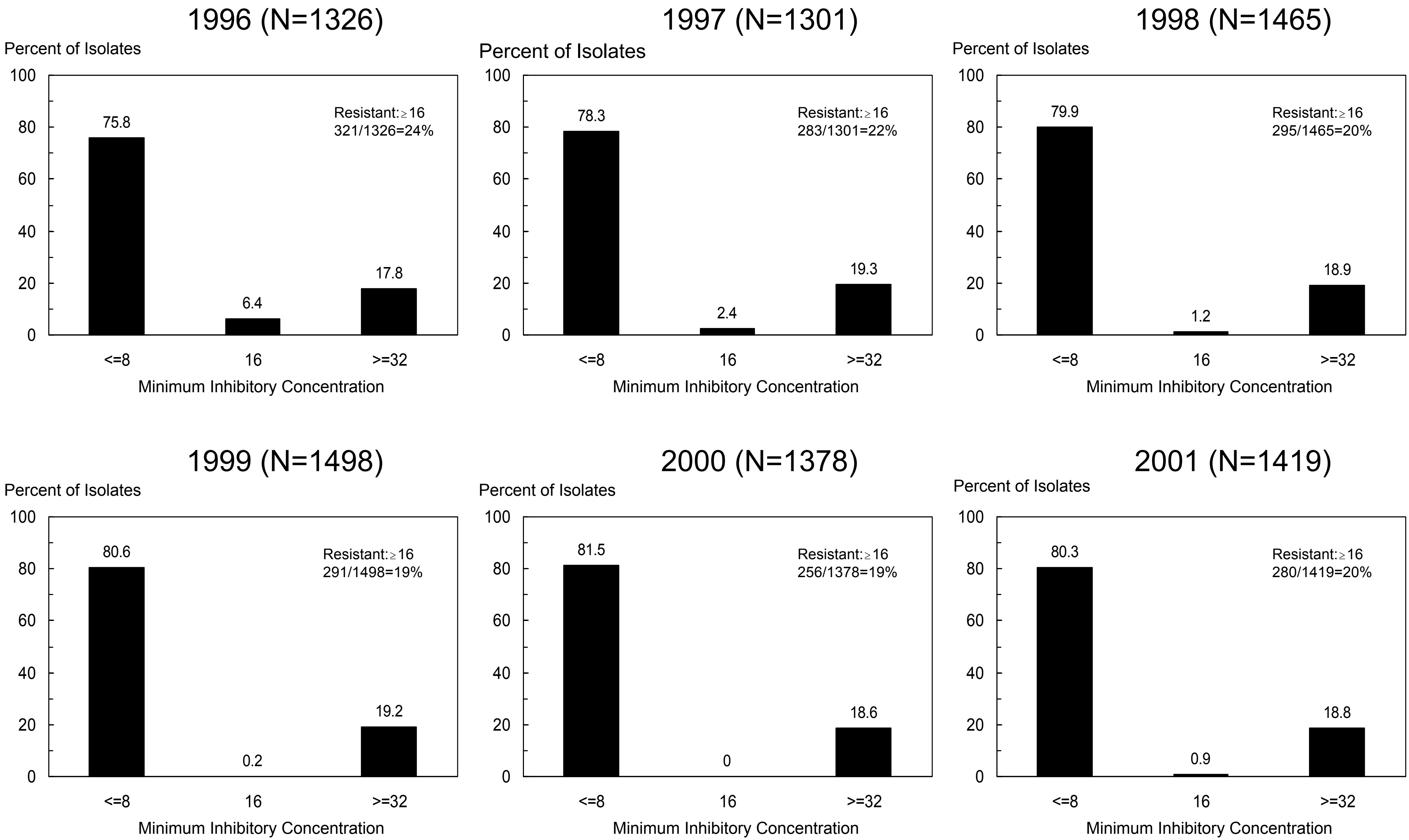

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Figure 2q. MICs for trimethoprim-sulfamethoxazole among non-Typhi *Salmonella* isolates, 1996-2001

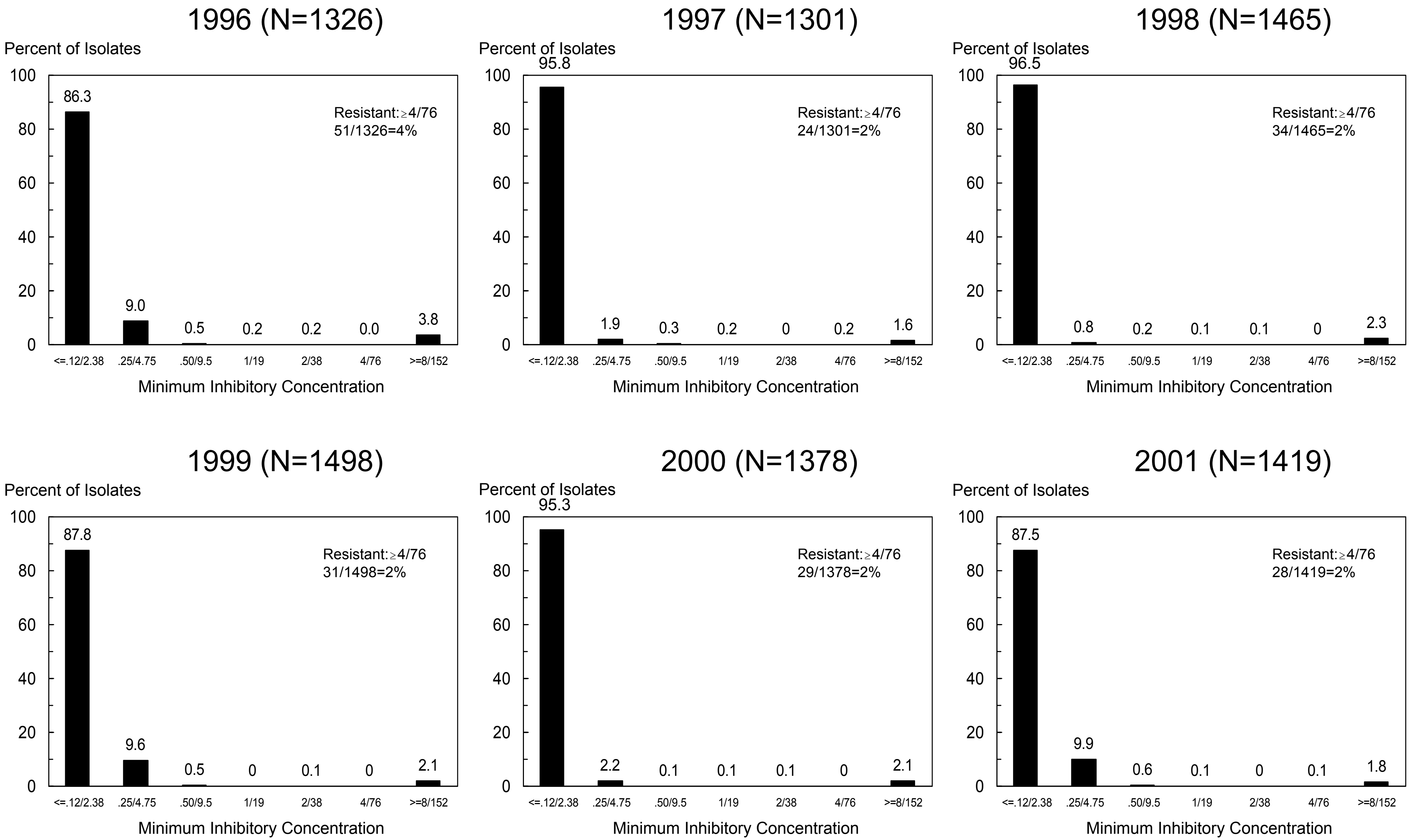

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Figure 3. Percent of non-Typhi *Salmonella* isolates (N=1419) that were pansusceptible, and percent resistant to ≥1, ≥2, ≥5, and ≥8 of the 18 antimicrobial agents tested, 2001

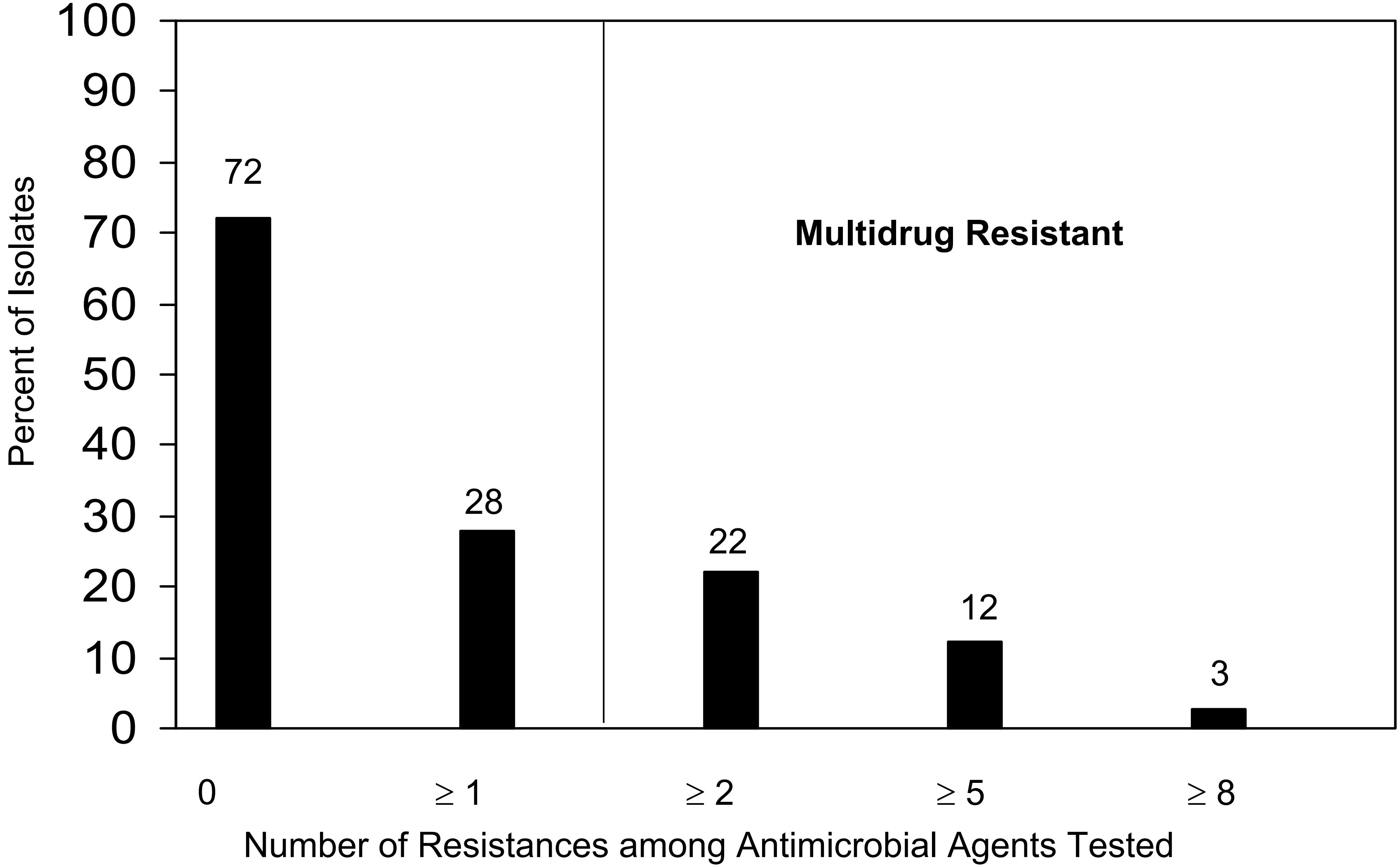

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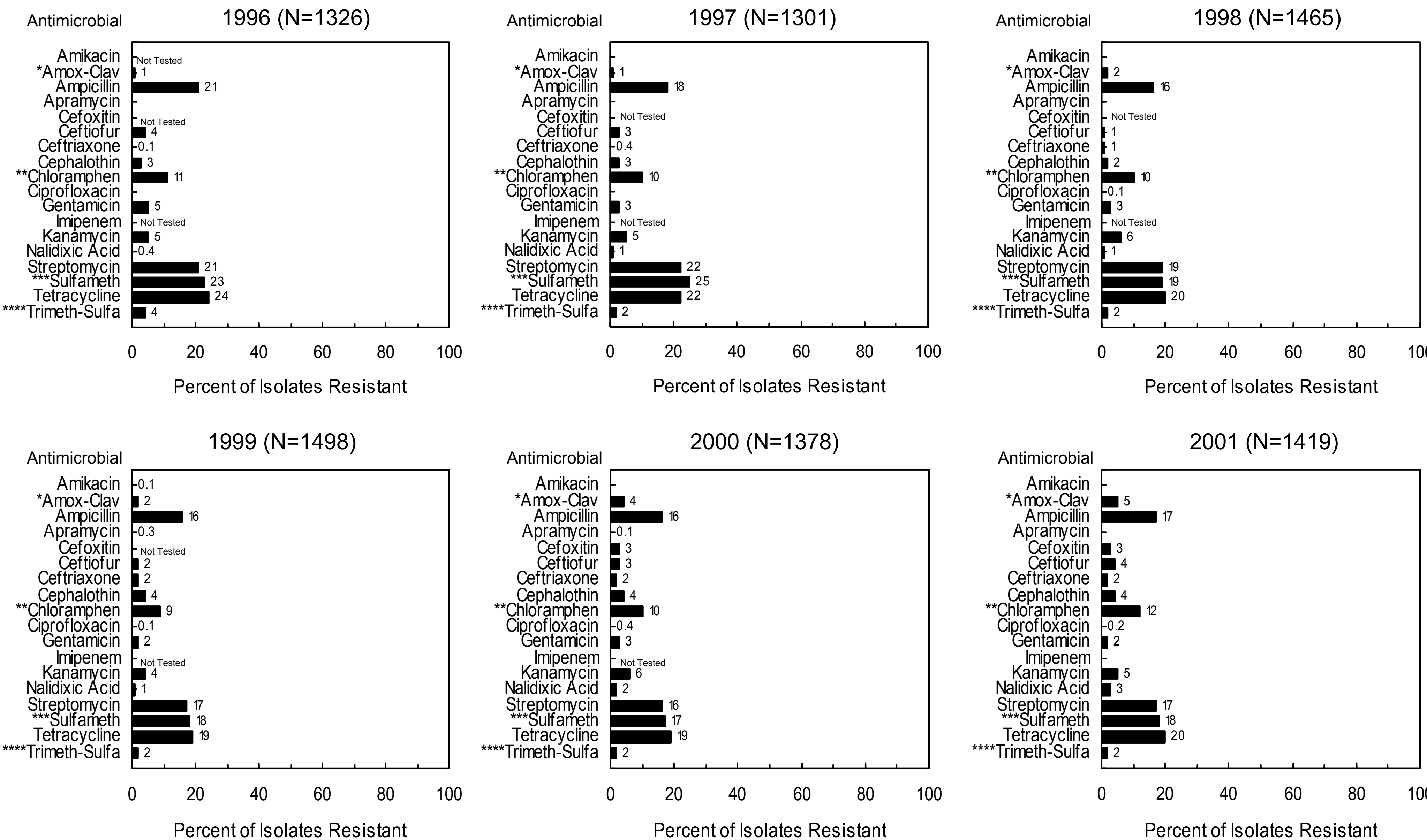
Figure 4. Resistance among non-Typhi *Salmonella* isolates, 1996-2001



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

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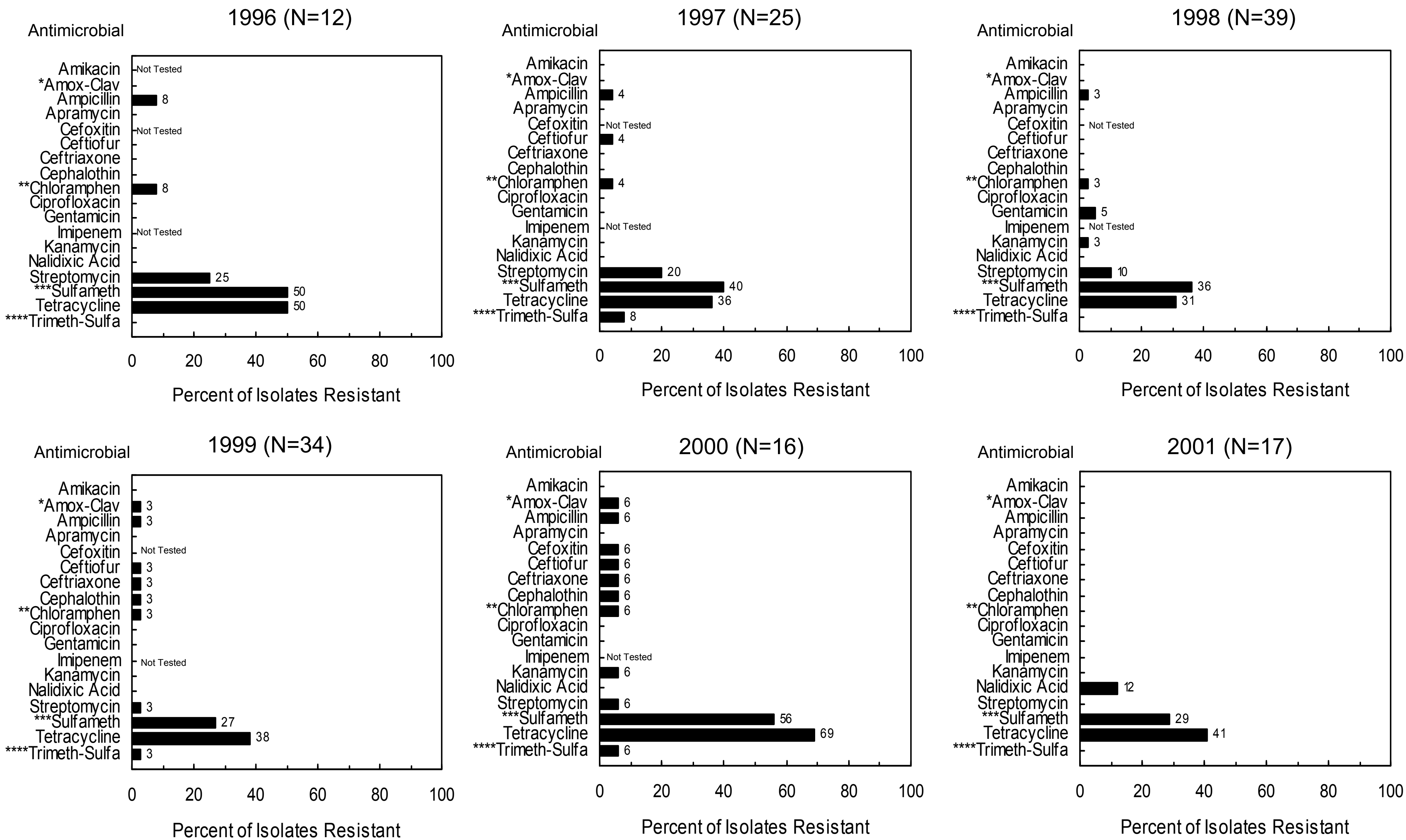
Figure 5a. Resistance among *Salmonella* serotype Agona isolates, 1996-2001



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

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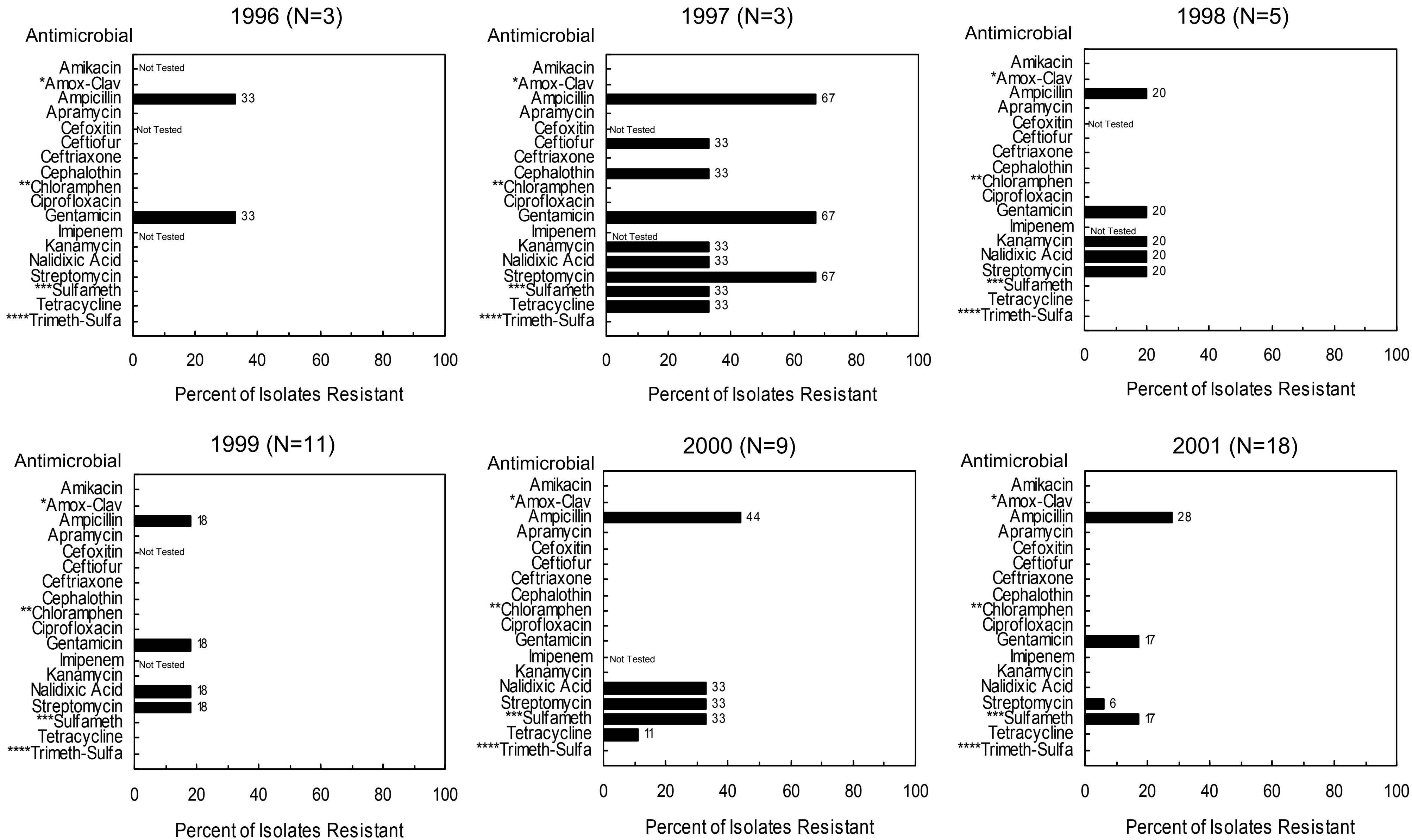
Figure 5b. Resistance among *Salmonella* serotype Berta isolates, 1996-2001



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

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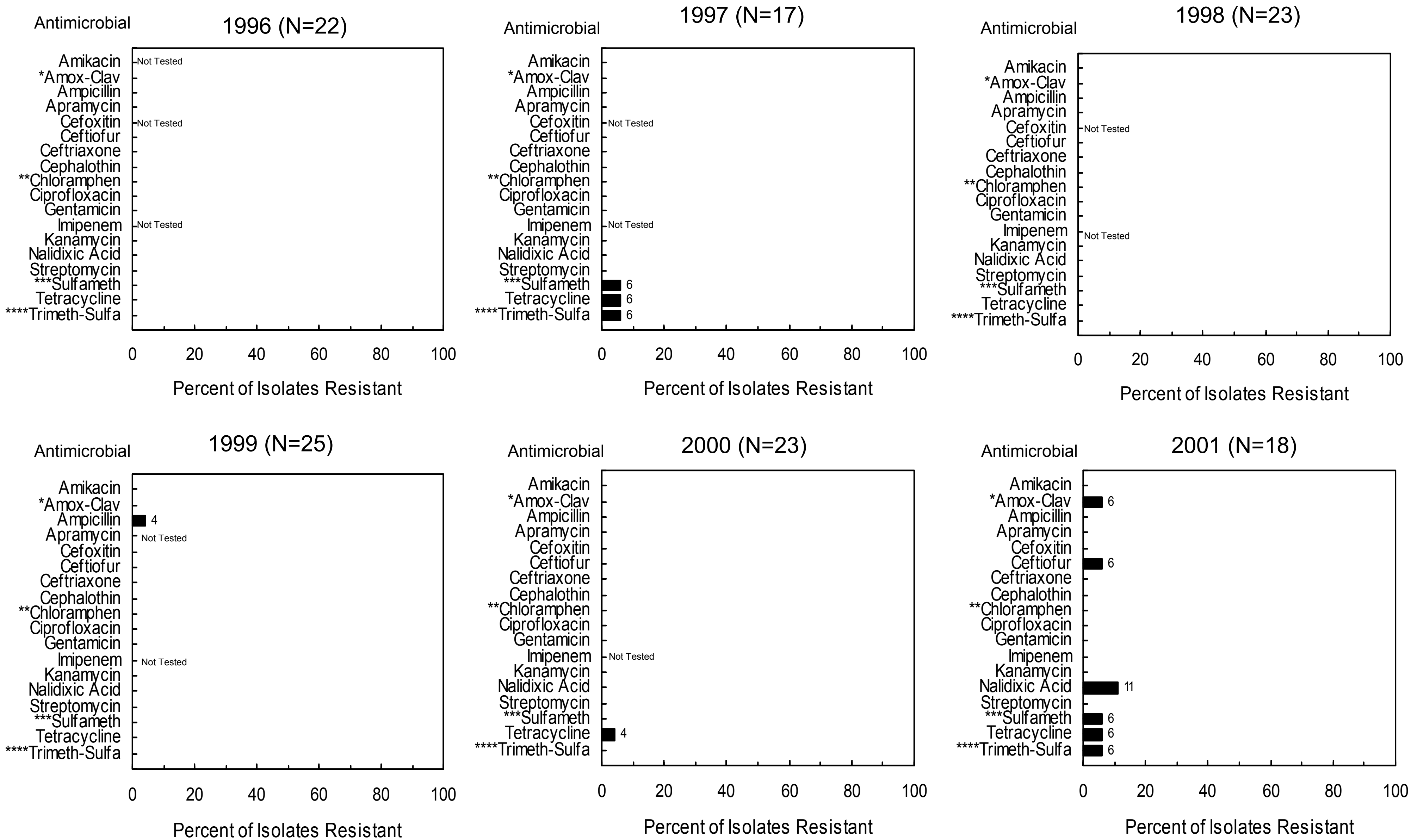
Figure 5c. Resistance among *Salmonella* serotype Braenderup isolates, 1996-2001



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

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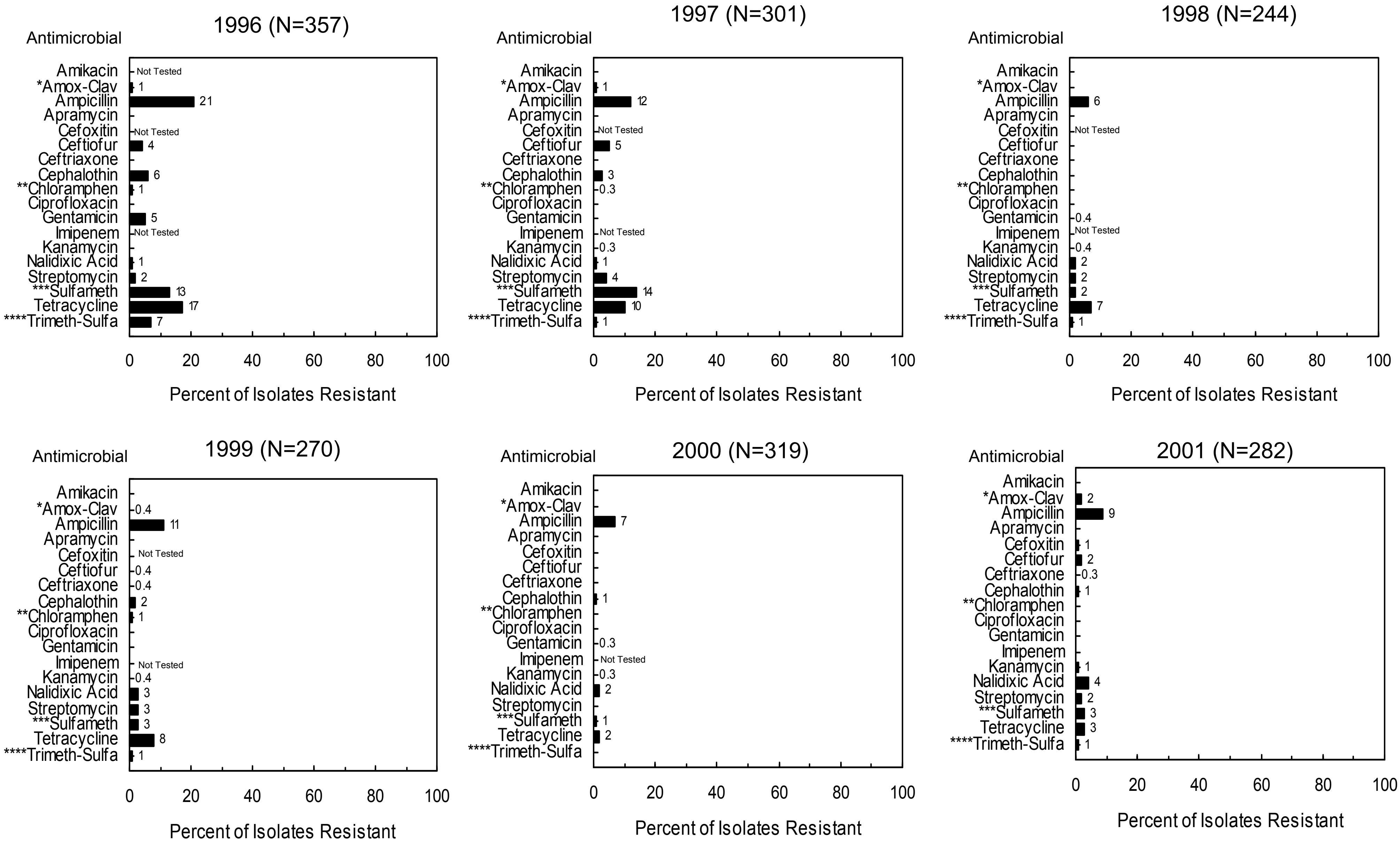
Figure 5d. Resistance among *Salmonella* serotype Enteritidis isolates, 1996-2001



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

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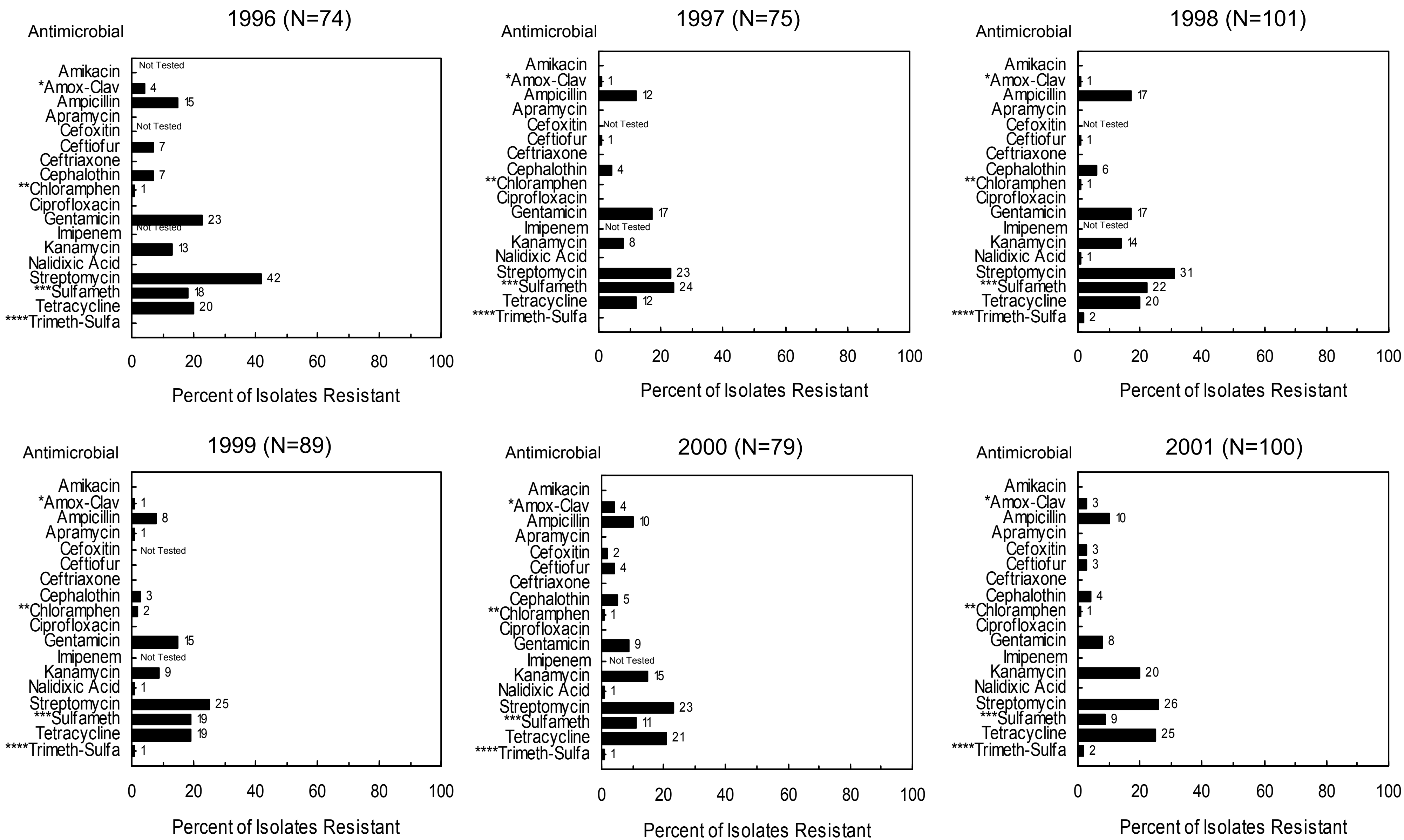
Figure 5e. Resistance among *Salmonella* serotype Heidelberg isolates, 1996-2001



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

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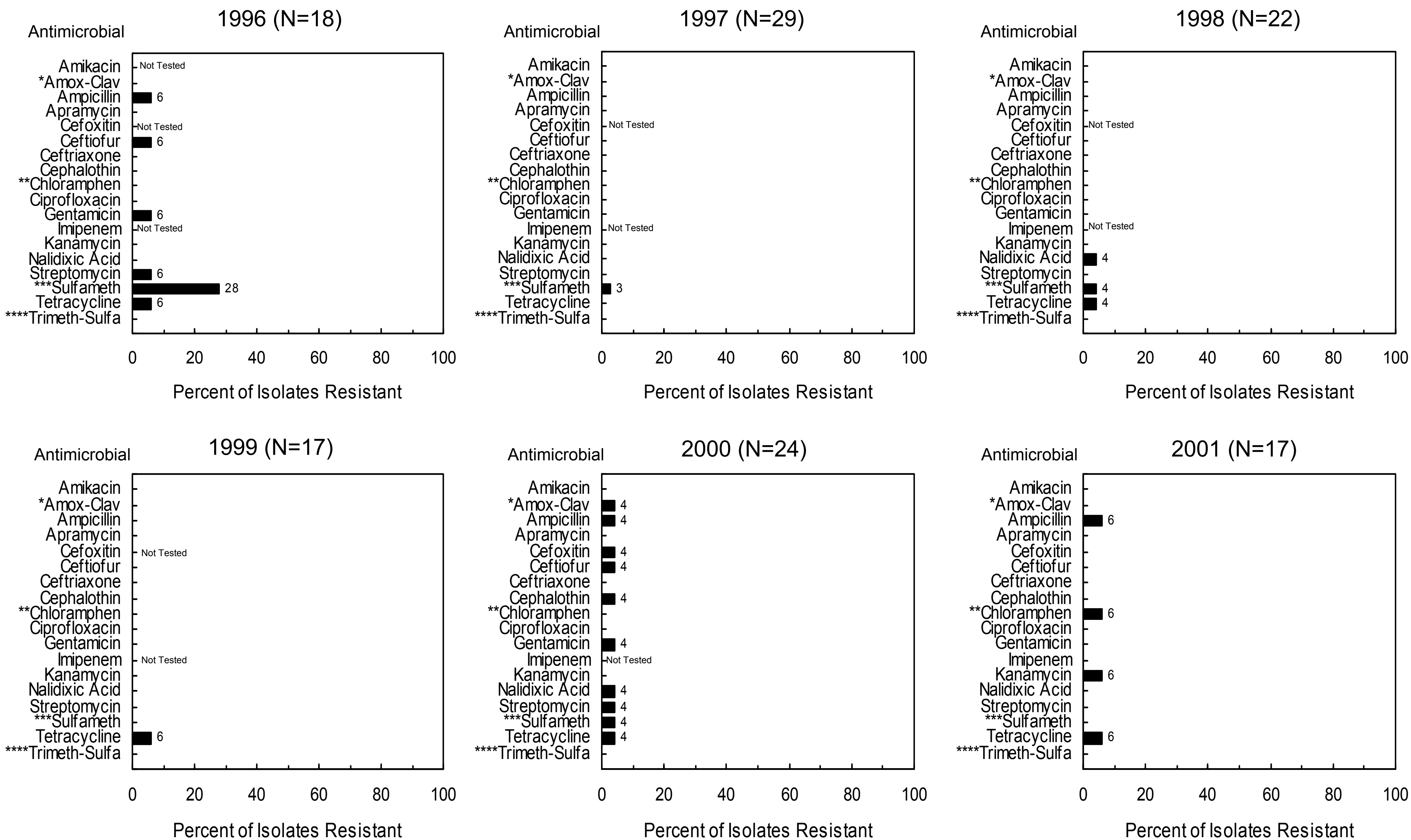
Figure 5f. Resistance among *Salmonella* serotype Infantis isolates, 1996-2001



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

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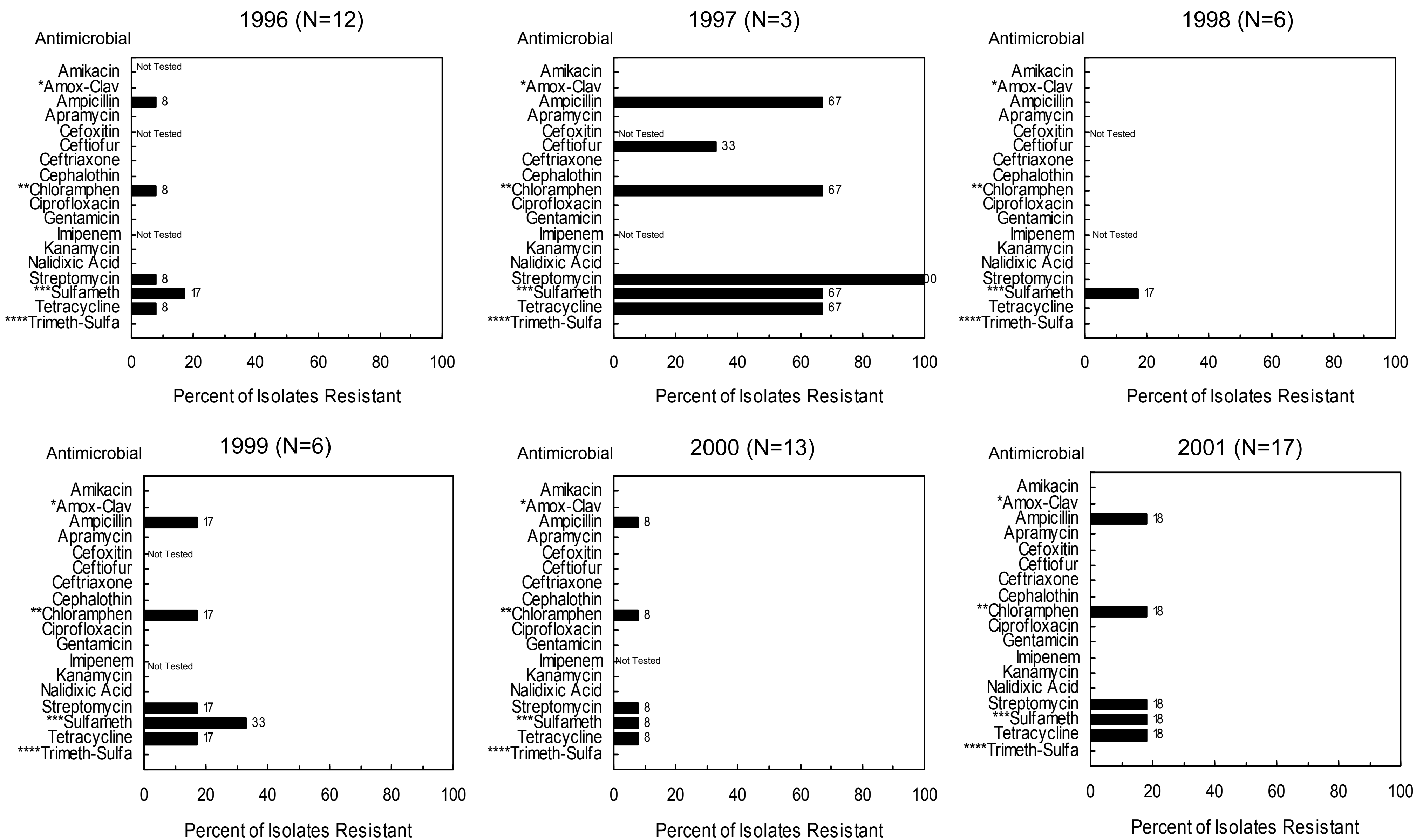
Figure 5g. Resistance among *Salmonella* serotype Java isolates, 1996-2001



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

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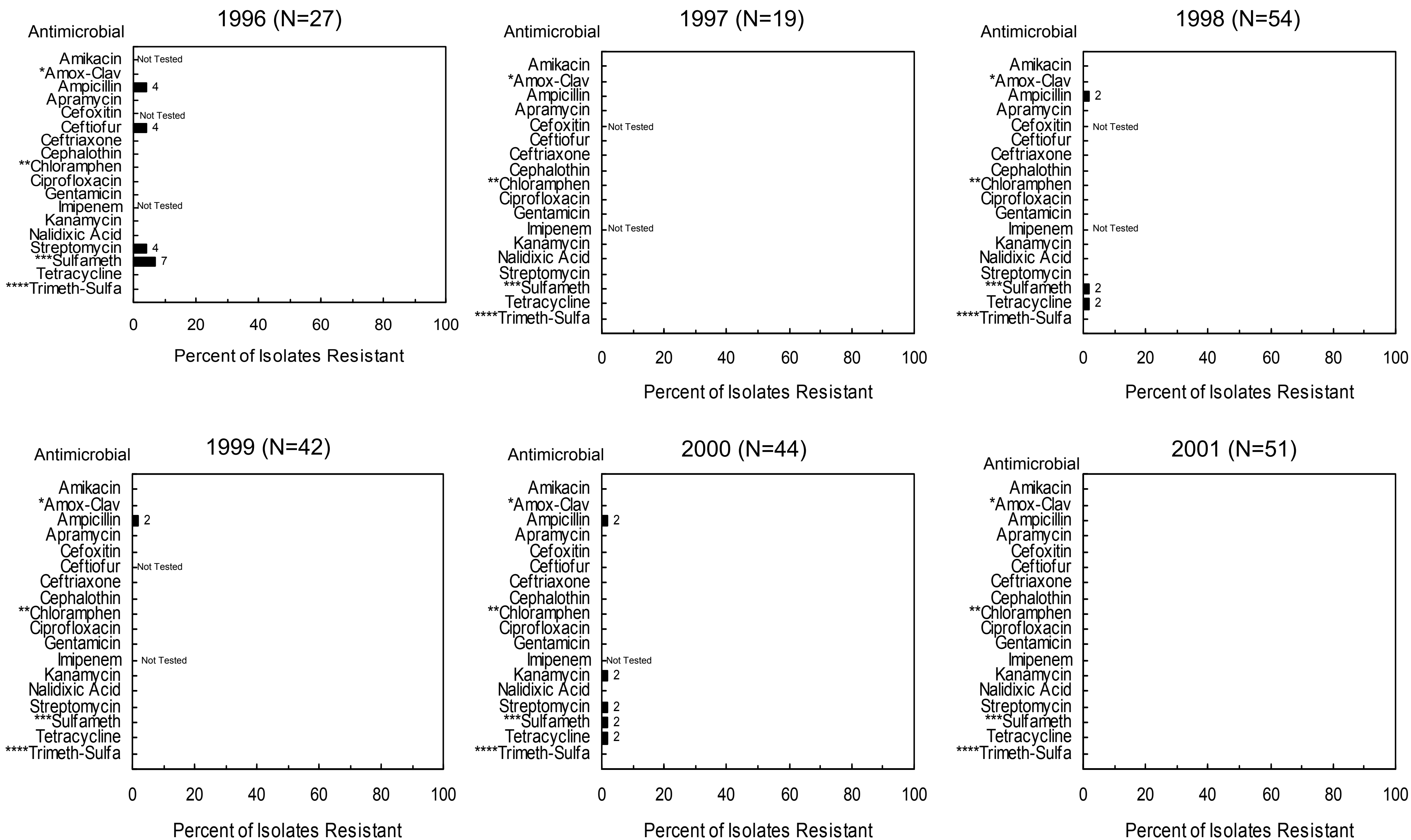
Figure 5h. Resistance among *Salmonella* serotype Javiana isolates, 1996-2001



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

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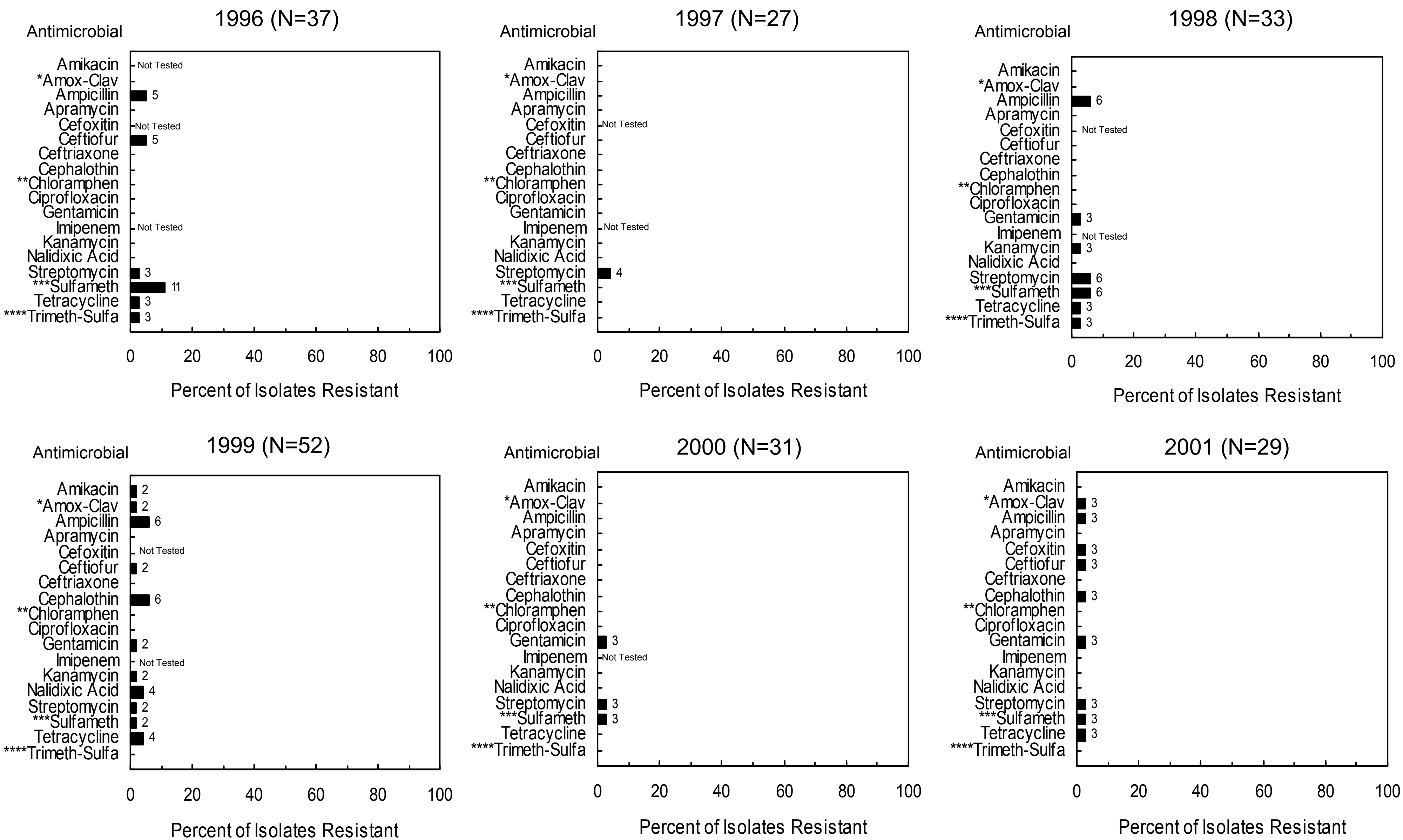
Figure 5i. Resistance among *Salmonella* serotype Montevideo isolates, 1996-2001



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

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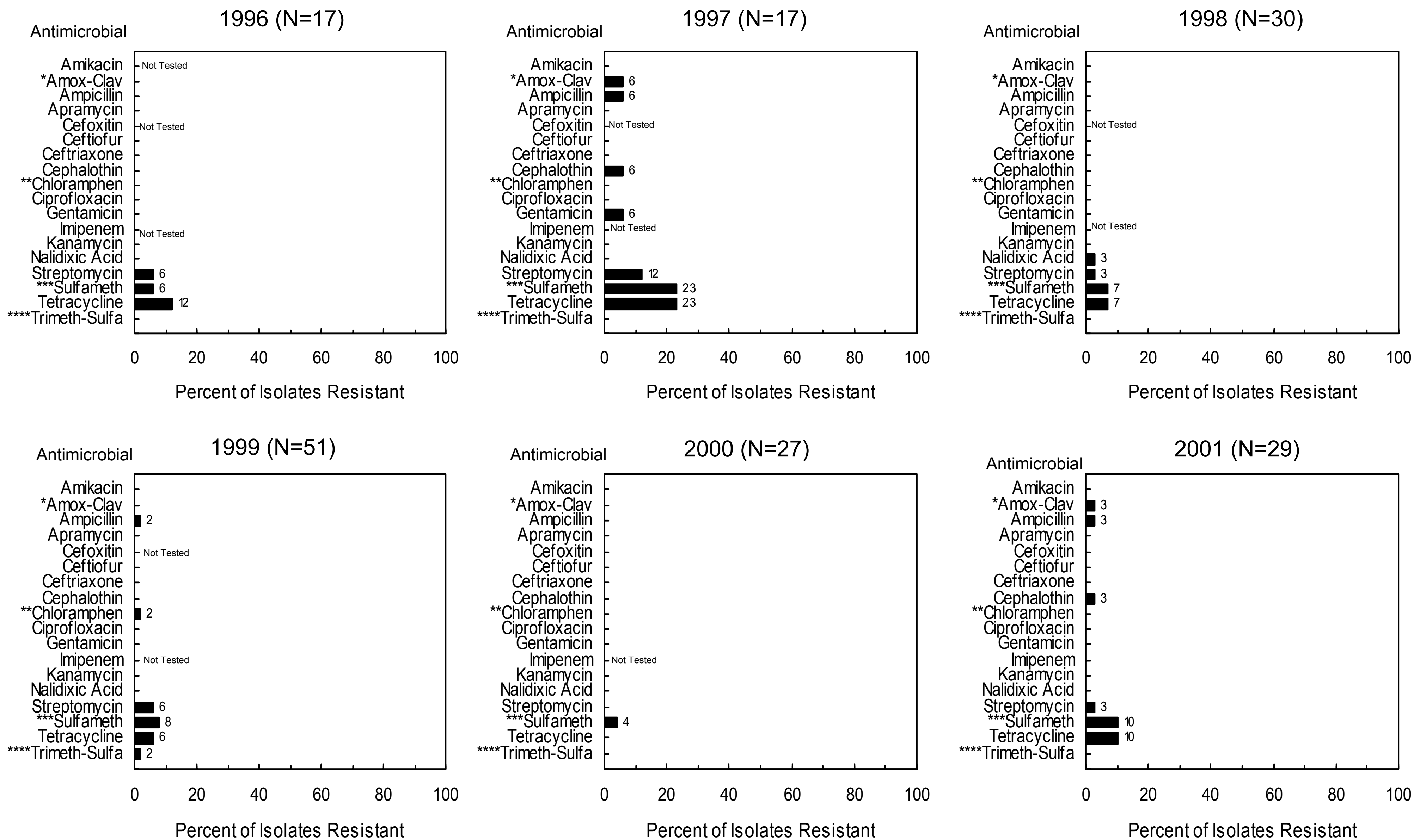
Figure 5j. Resistance among *Salmonella* serotype Muenchen isolates, 1996-2001



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

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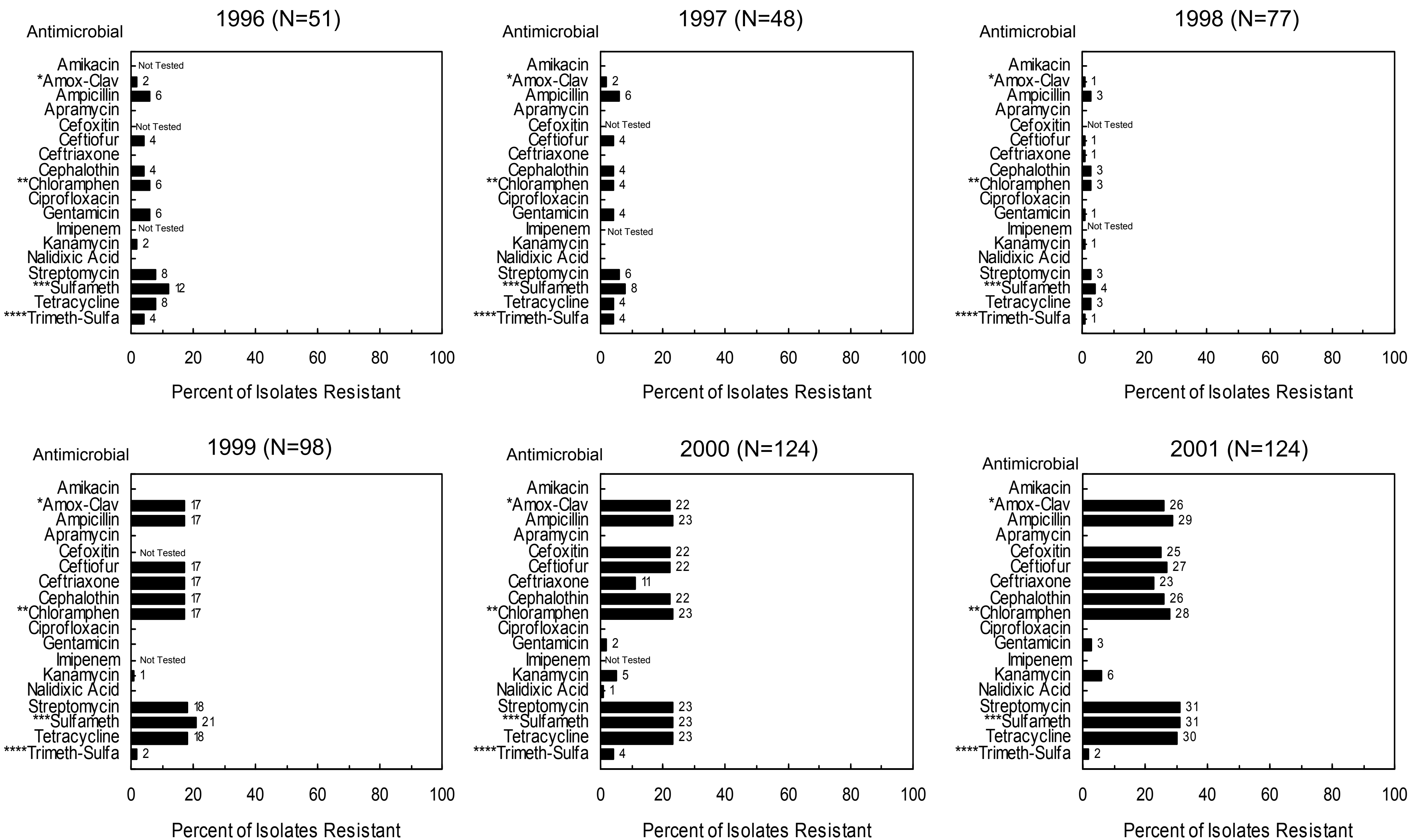
Figure 5k. Resistance among *Salmonella* serotype Newport isolates, 1996-2001



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

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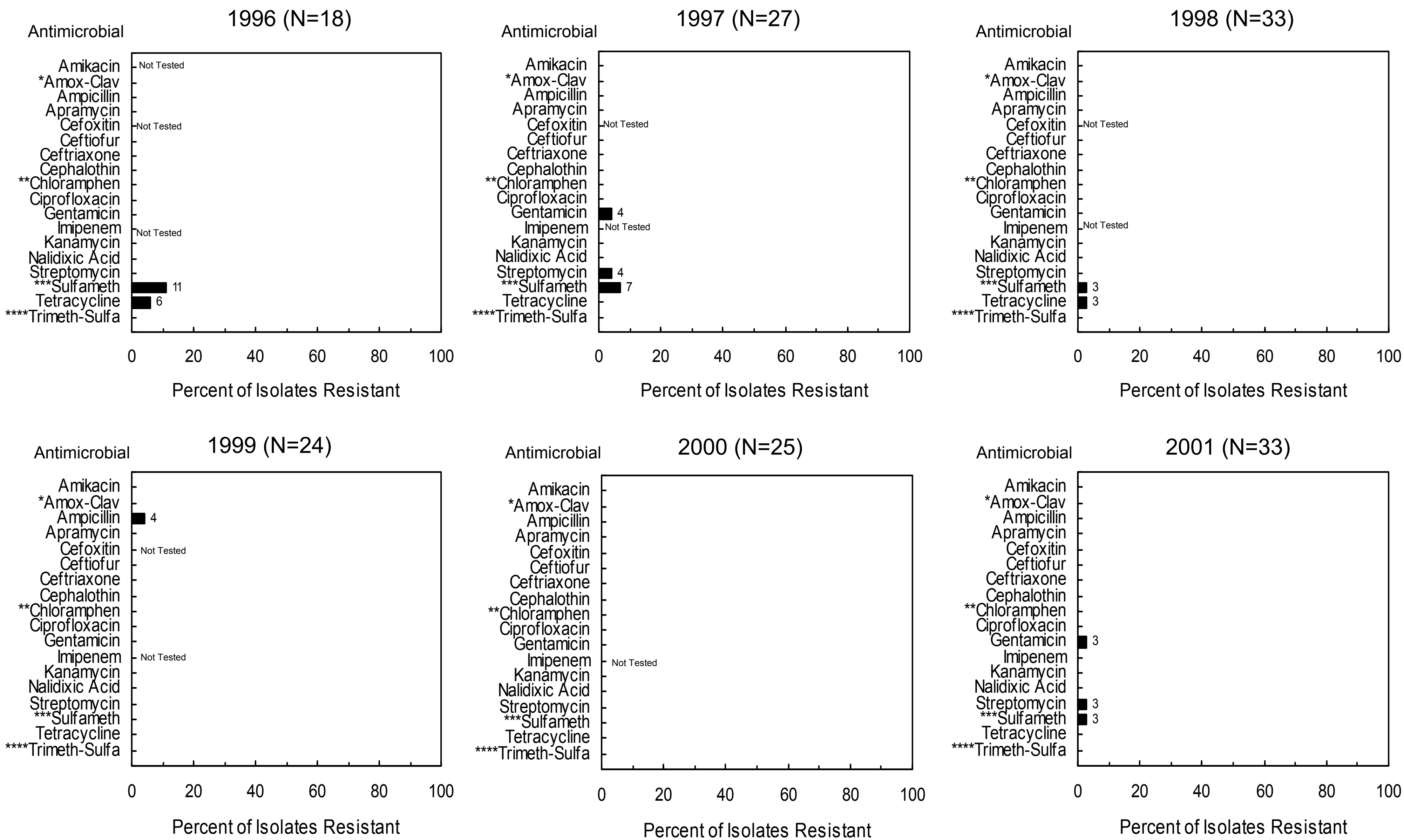
Figure 5I. Resistance among *Salmonella* serotype Oranienburg isolates, 1996-2001



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

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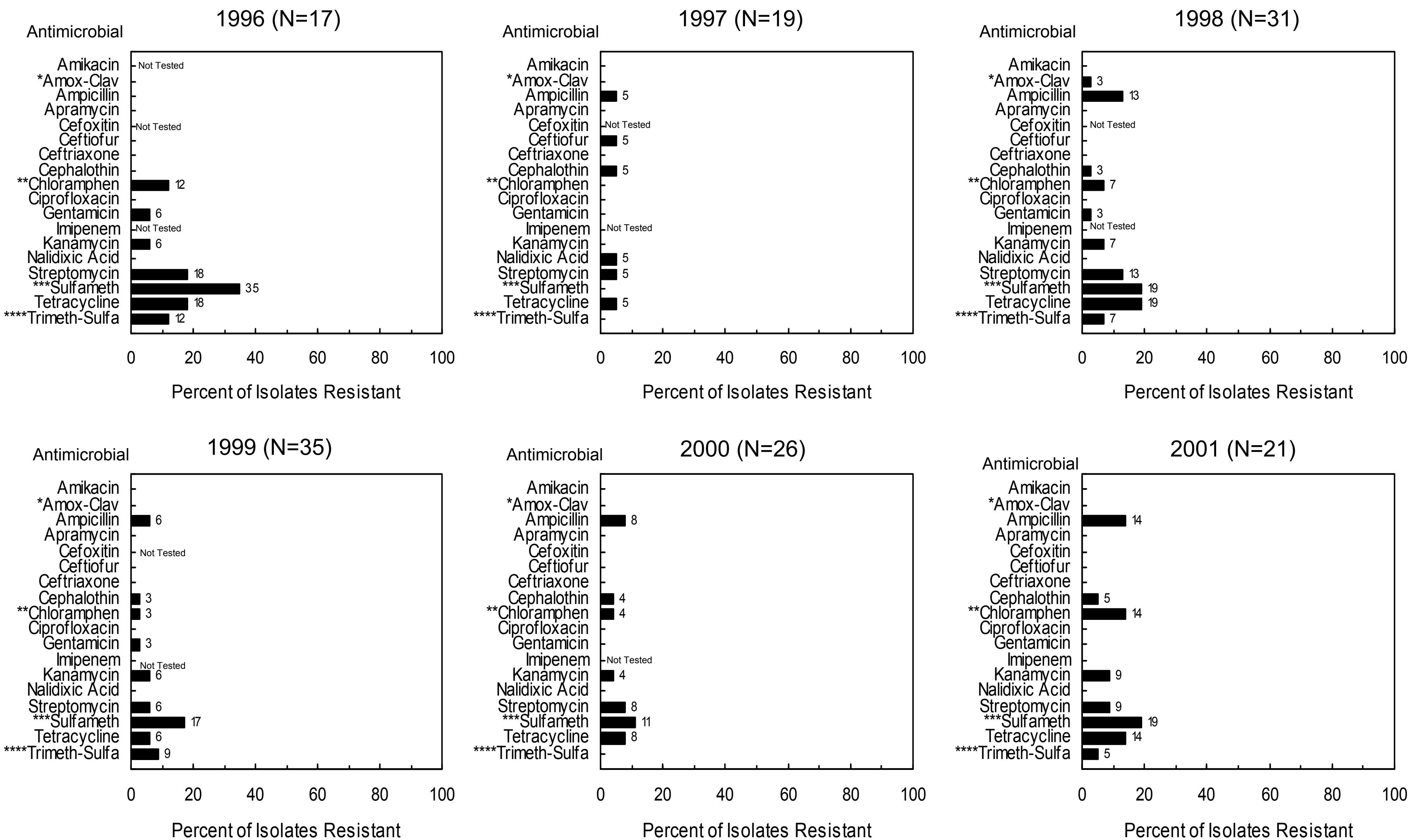
Figure 5m. Resistance among *Salmonella* serotype Saint Paul isolates, 1996-2001



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

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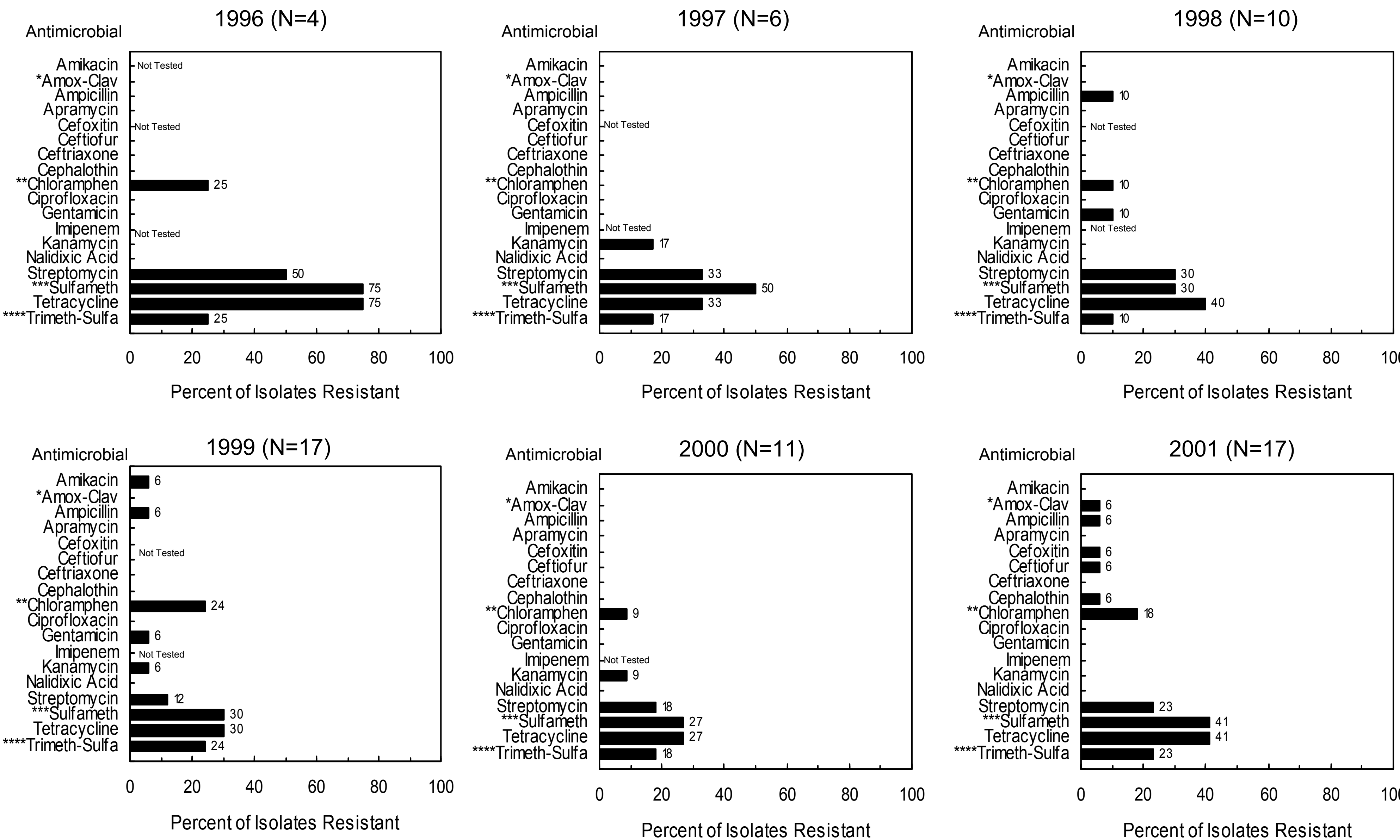
Figure 5n. Resistance among *Salmonella* serotype Stanley isolates, 1996-2001



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

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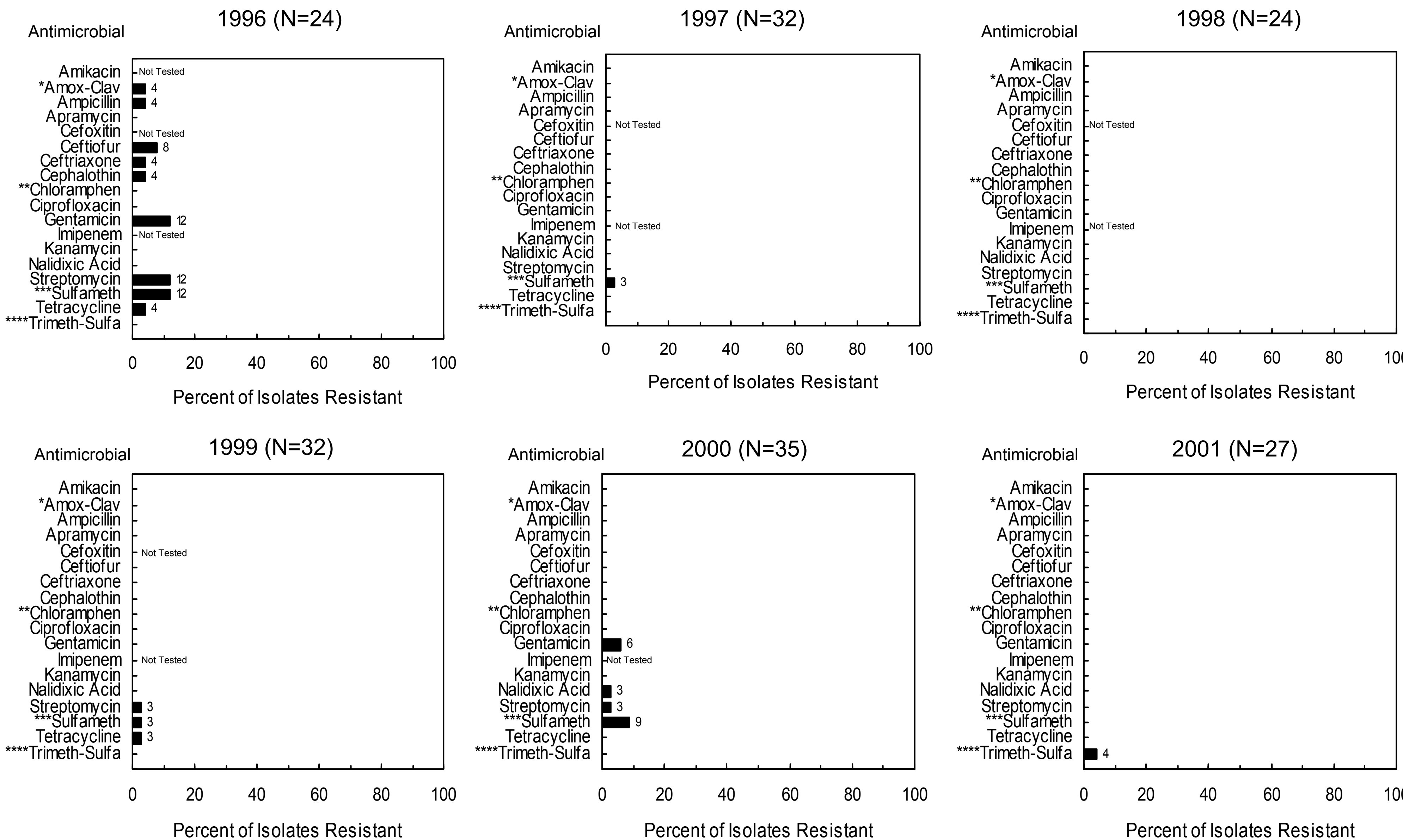
Figure 5o. Resistance among *Salmonella* serotype Thompson isolates, 1996-2001



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

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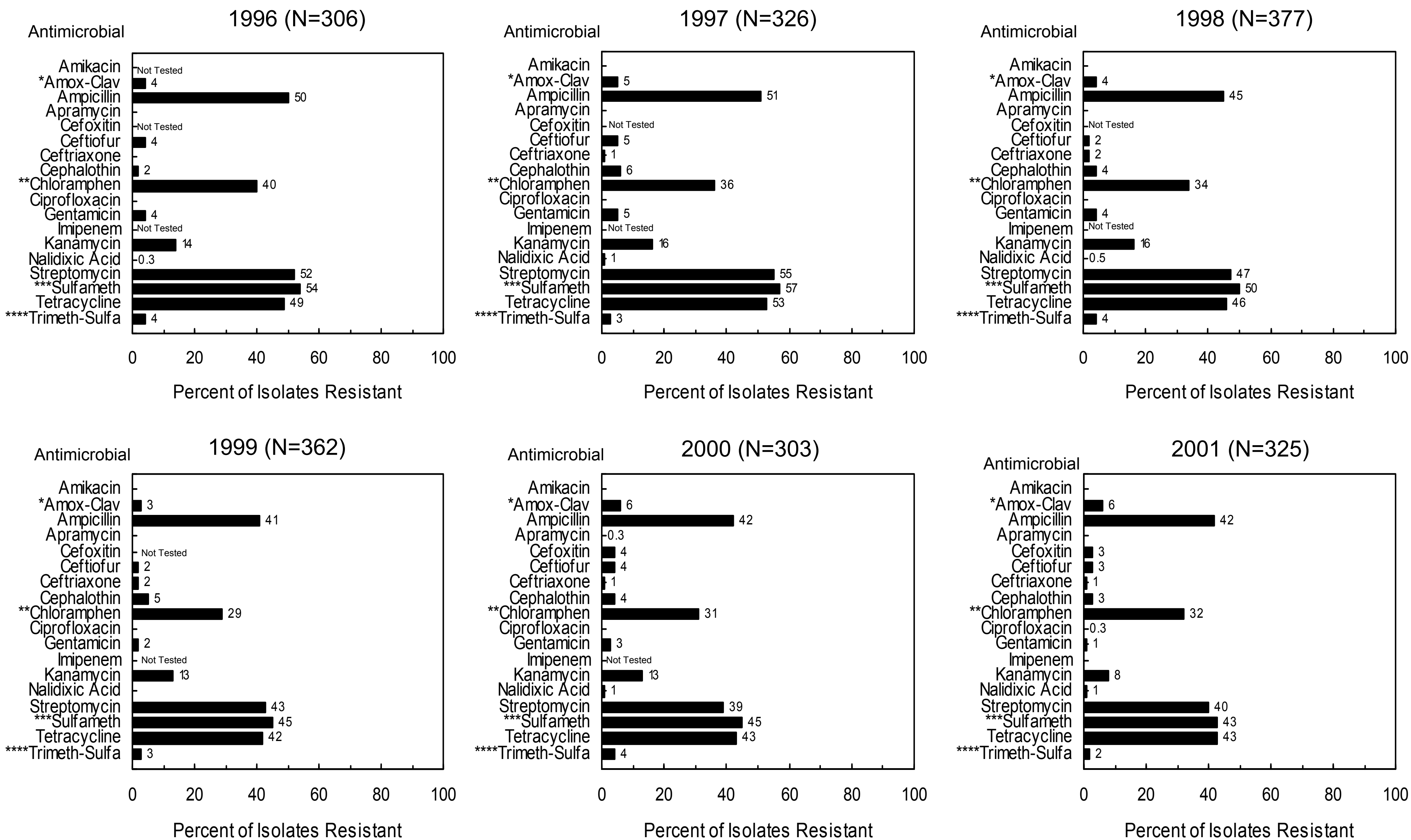
Figure 5p. Resistance among *Salmonella* serotype Typhimurium isolates, 1996-2001



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

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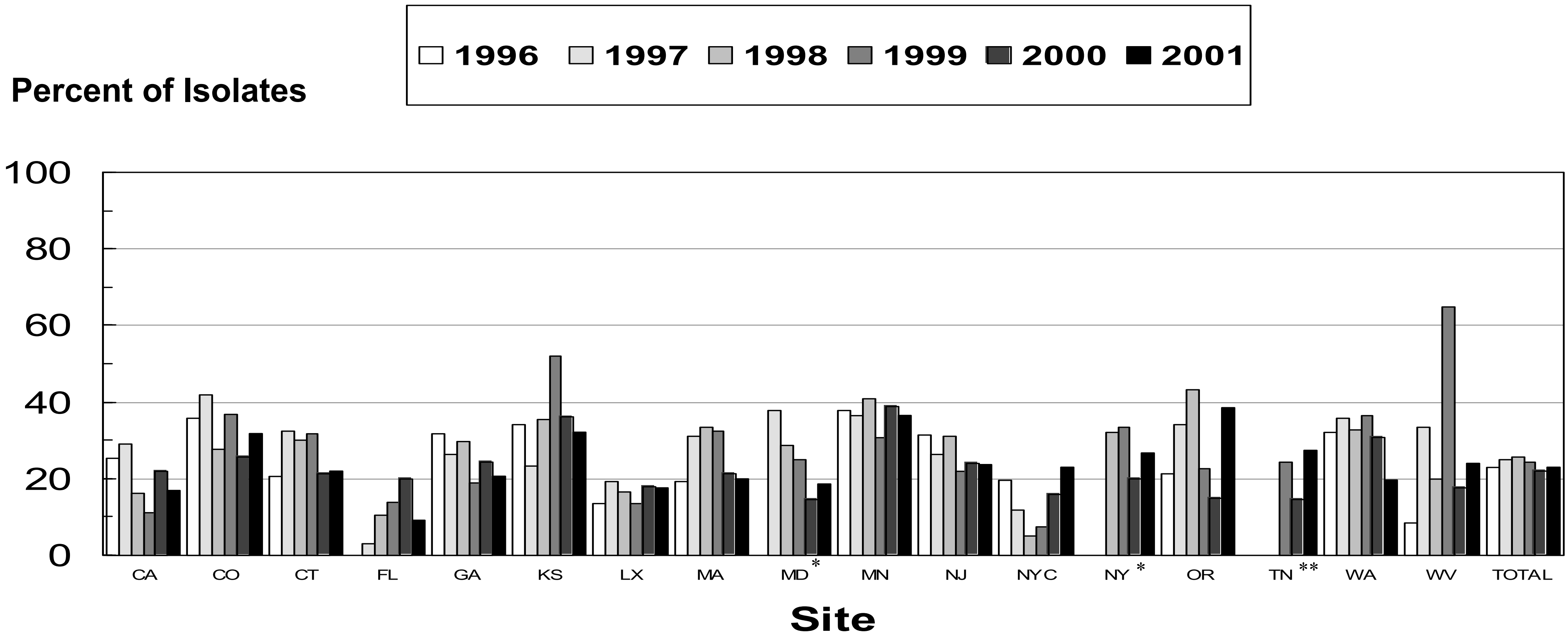
Figure 6. Percent of non-Typhi *Salmonella* isolates that are serotype Typhimurium, by site, 1996-2001



Percent Typhimurium for all sites:

1996 - 306 /1326 = 23%   1997 - 326/1301 = 25%   1998 - 377/1465 = 26%

1999 - 362/1498 = 24%   2000 - 303/1378 = 22%   2001 - 325/1419 = 23%

CA=Alameda, Contra Costa, and San Francisco counties
LX=Los Angeles County
NY=excluding New York City
NYC=New York City

* Joined NARMS in 1997

** Joined NARMS in 1999

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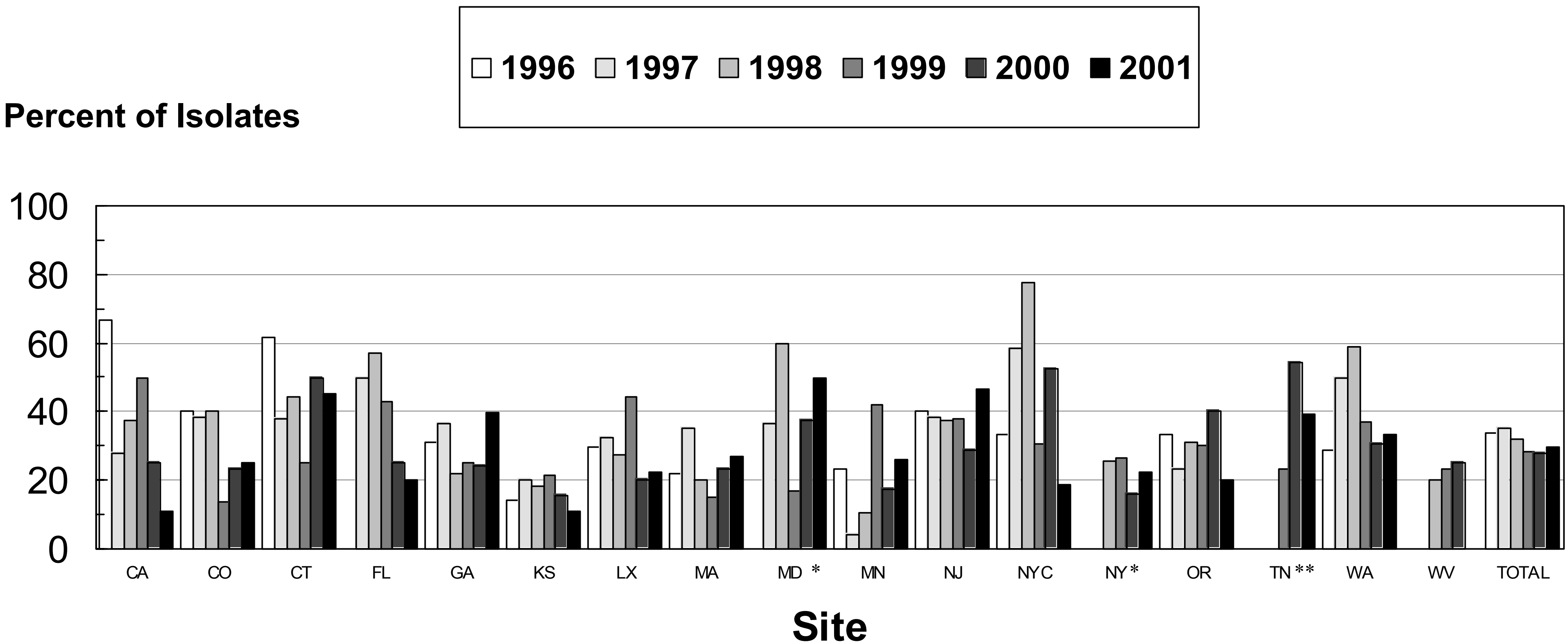
Figure 7. Percent of *Salmonella* Typhimurium isolates that are resistant to at least ampicillin, chloramphenicol, streptomycin, sulfamethoxazole, and tetracycline (ACSSuT), by site, 1996–2001



Percent Typhimurium with at least ACSSuT pattern for all sites:

1996 - 103/306 = 34%   1997 - 115/326 = 35%   1998 - 120/377 = 32%

1999 - 102/362 = 28%   2000 - 84/303 = 28%   2001 - 96/325 = 29%

CA=Alameda, Contra Costa, and San Francisco counties
LX=Los Angeles County
NY=excluding New York City
NYC=New York City

* Joined NARMS in 1997

** Joined NARMS in 1999

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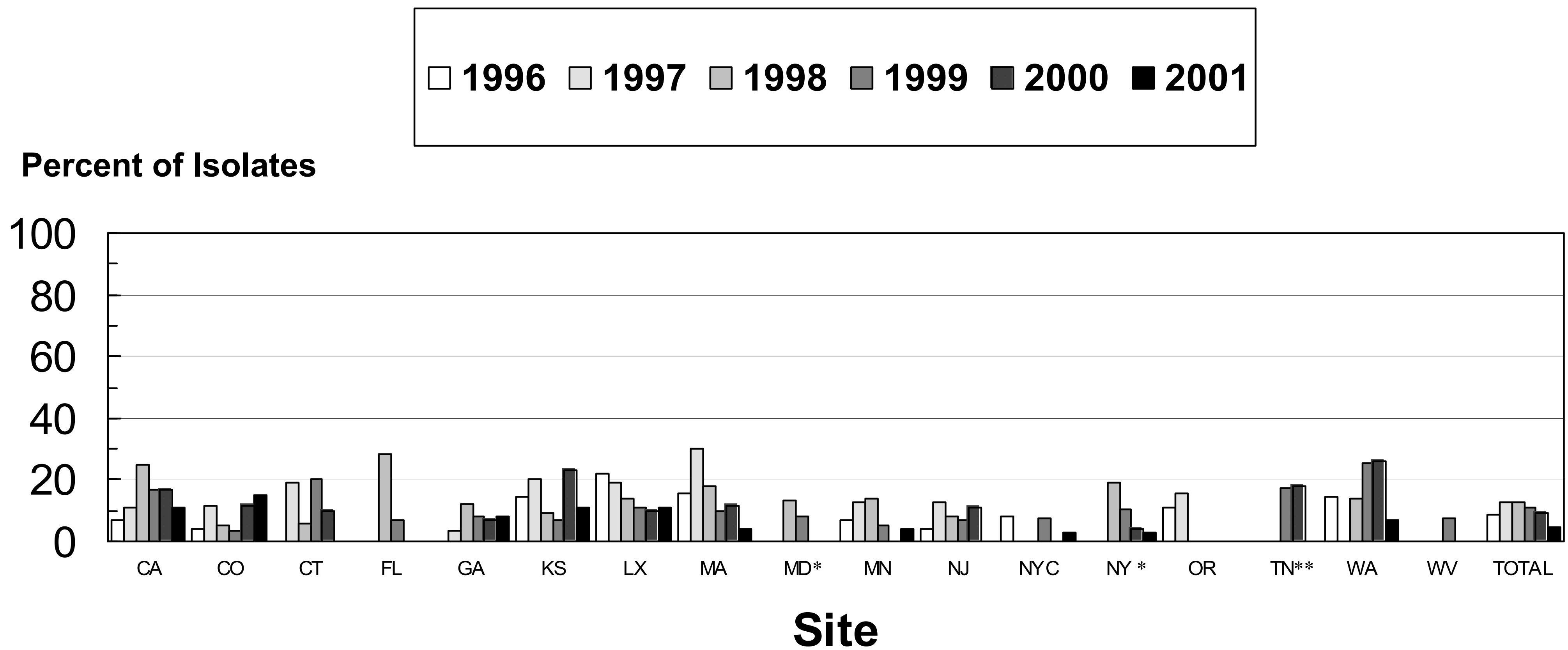
Figure 8. Percent of *Salmonella* Typhimurium isolates that are resistant to at least ampicillin, kanamycin, streptomycin, sulfamethoxazole, and tetracycline (AKSSuT), by site, 1996-2001



Percent Typhimurium with at least AKSSuT pattern for all sites:

1996 - 27/306 = 9% 1997 - 41/326 = 13% 1998 - 47/377 = 12%

1999 - 39/362 = 11% 2000 - 28/303 = 9% 2001 - 15/325 = 5%

CA=Alameda, Contra Costa, and San Francisco counties
LX=Los Angeles County
NY=excluding New York City
NYC=New York City

* Joined NARMS in 1997

** Joined NARMS in 1999

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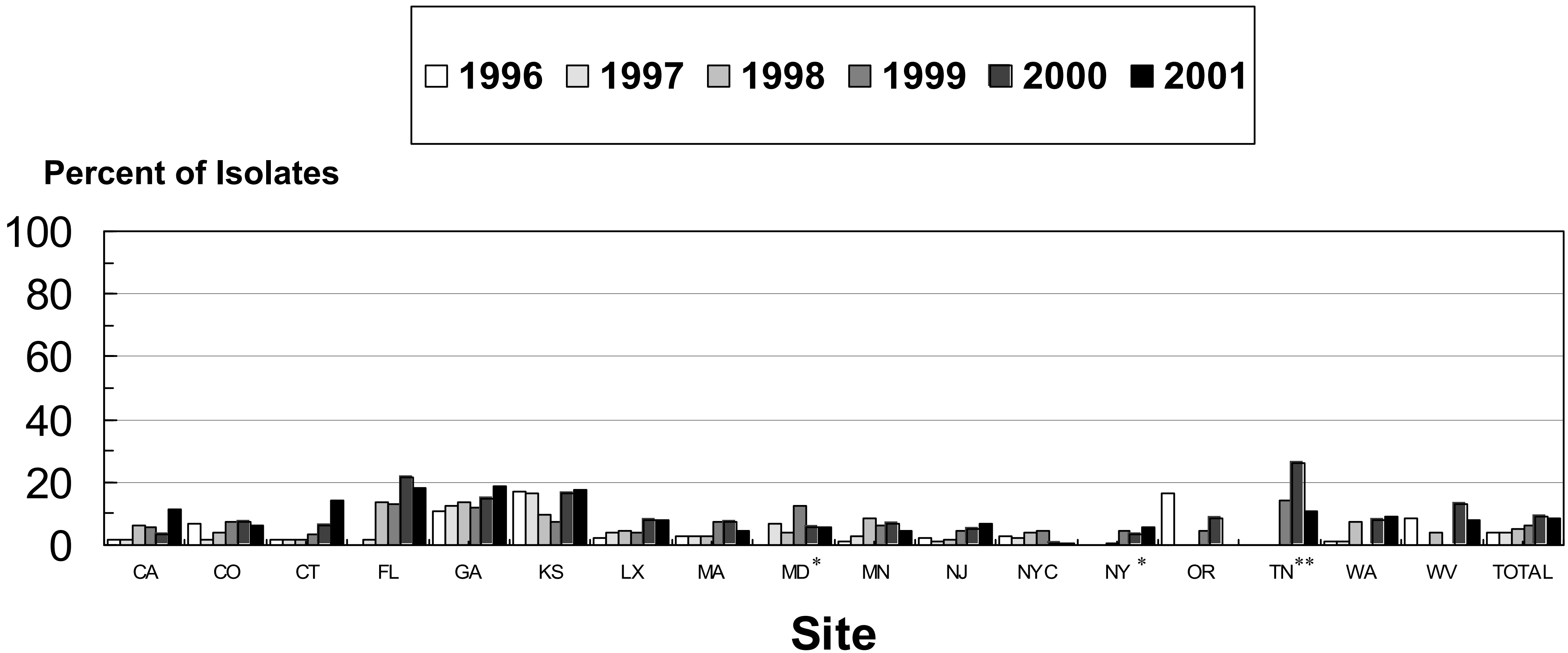
Figure 9. Percent of non-Typhi *Salmonella* isolates that are serotype Newport, by site, 1996-2001



Percent Newport for all sites

1996 - 51/1326 = 4%   1997 - 48/1301 = 4%   1998 - 77/1465= 5%

1999 - 98/1498 = 7%   2000 - 124/1378 = 9%   2001 - 124/1419 = 9%

CA=Alameda, Contra Costa, and San Francisco counties
LX=Los Angeles County
NY=excluding New York City
NYC=New York City

* Joined NARMS in 1997

** Joined NARMS in 1999

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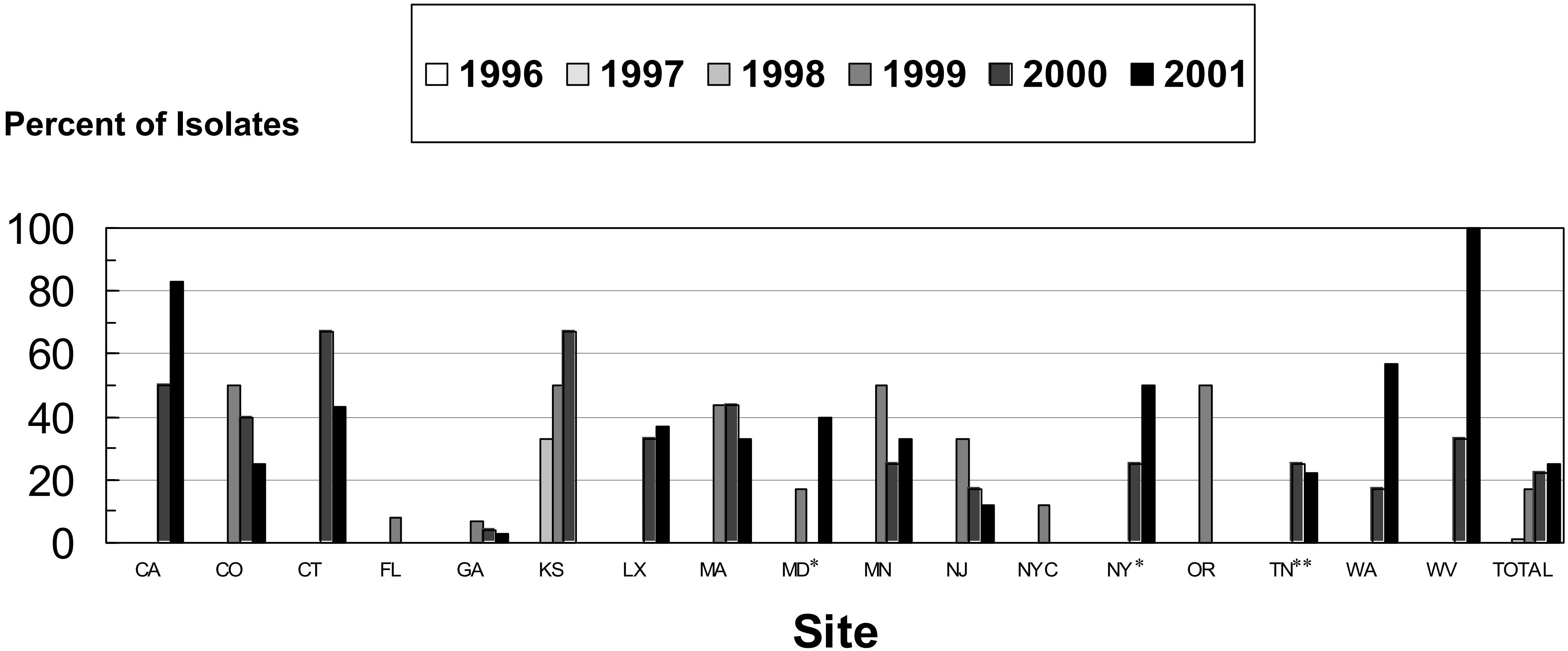
Figure 10. Percent of *Salmonella* Newport isolates that are at least MDR-AmpC‡, by site, 1996-2001



‡MDR-AmpC=Resistance to Amoxicillin/Clavulanic Acid, Ampicillin, Cephalothin, Cefoxitin, Ceftiofur, Chloramphenicol, Sulfamethoxazole, Streptomycin and Tetracycline, and Decreased Susceptibility to Ceftriaxone (MIC ≥ 16 μg/ml)

Percent Newport with MDR-AmpC pattern for all sites:

1996 - 0/51 = 0% 1997 - 0/48 = 0% 1998 - 1/77 = 1%

1999 - 17/98 = 17% 2000 - 27/124 = 22% 2001 = 31/124 = 25%

CA=Alameda, Contra Costa, and San Francisco counties
LX=Los Angeles County
NY=excluding New York City
NYC=New York City

* Joined NARMS in 1997

** Joined NARMS in 1999

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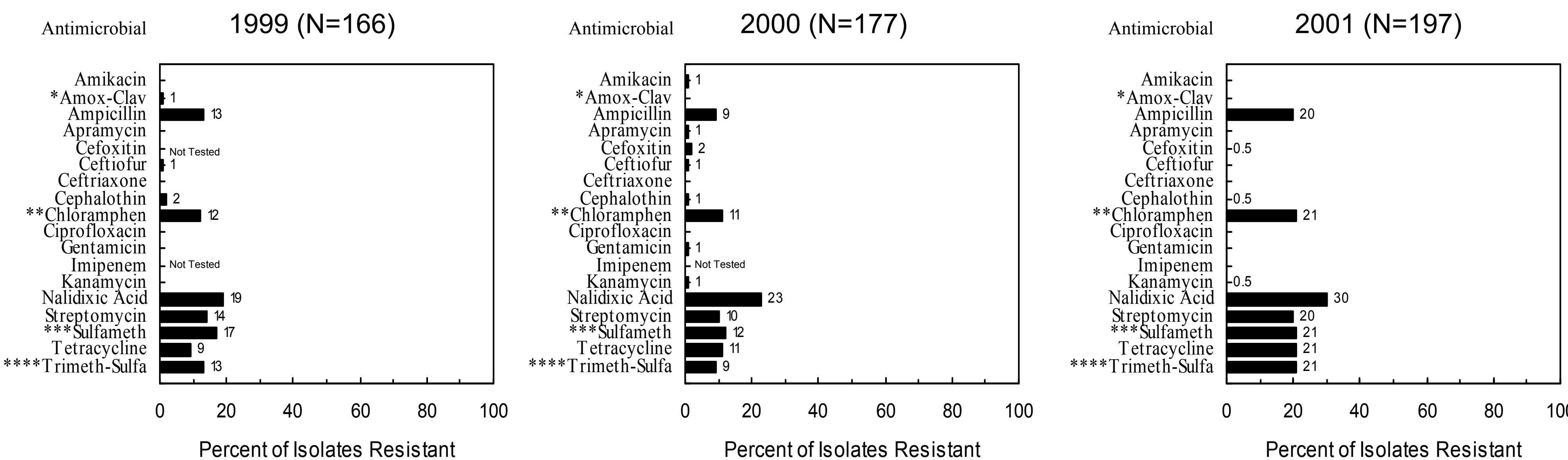
Figure 11. Resistance among *Salmonella* Typhi isolates, 1999-2001



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

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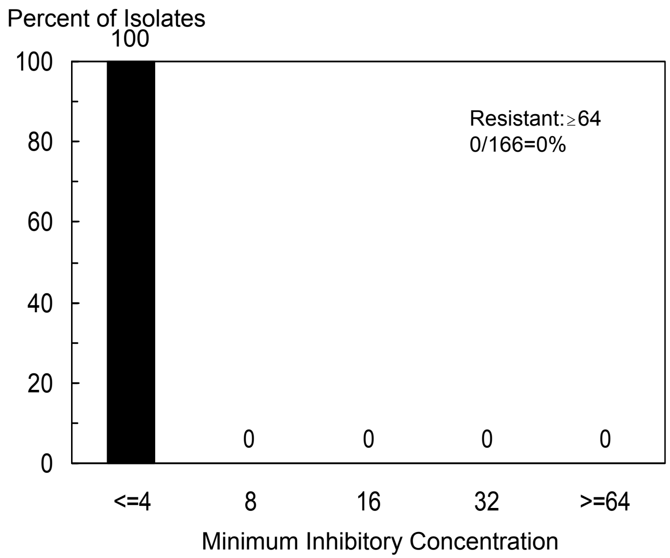
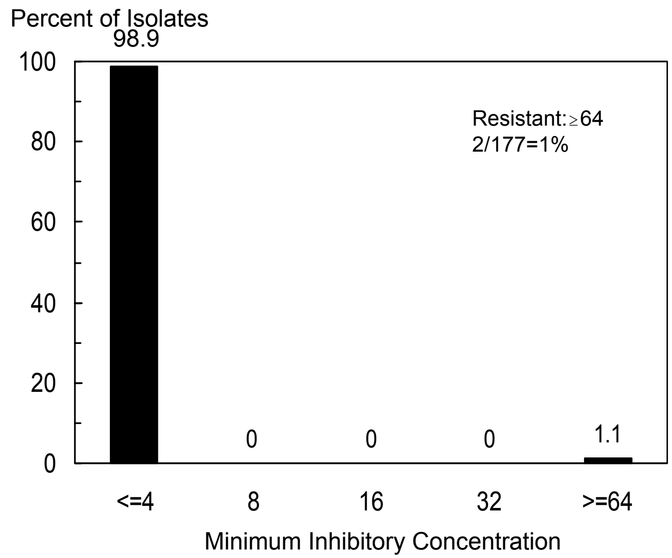
Figure 12a. MICs for amikacin among *Salmonella* Typhi isolates, 1999-2001

1999 (N=166)



2000 (N=177)



2001 (N=197)

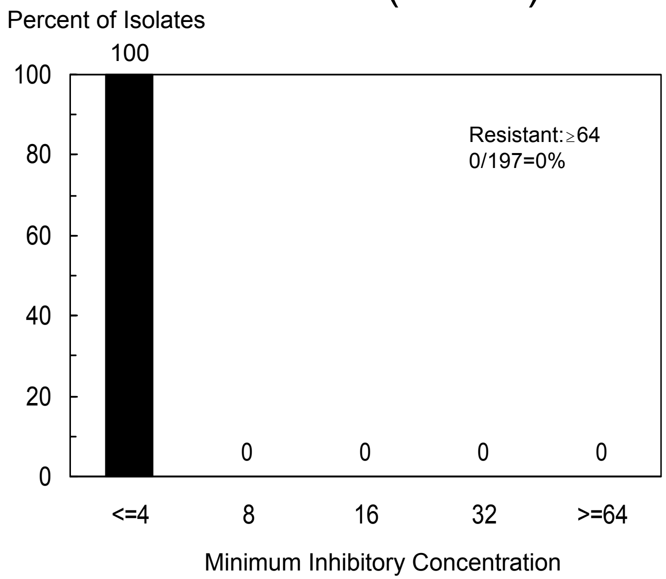


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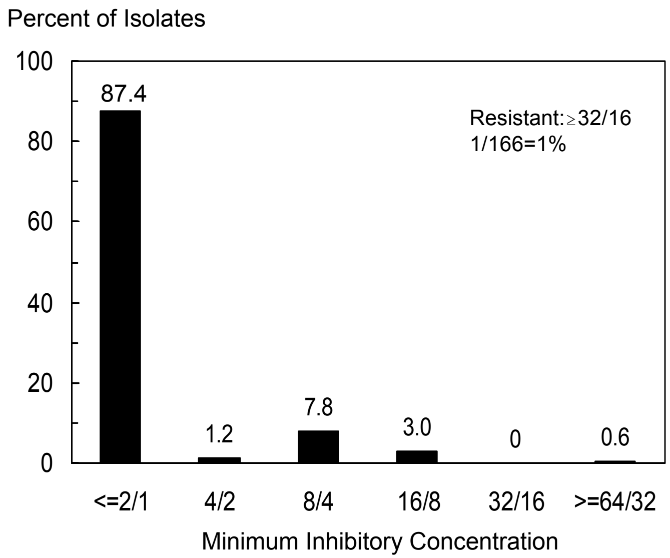
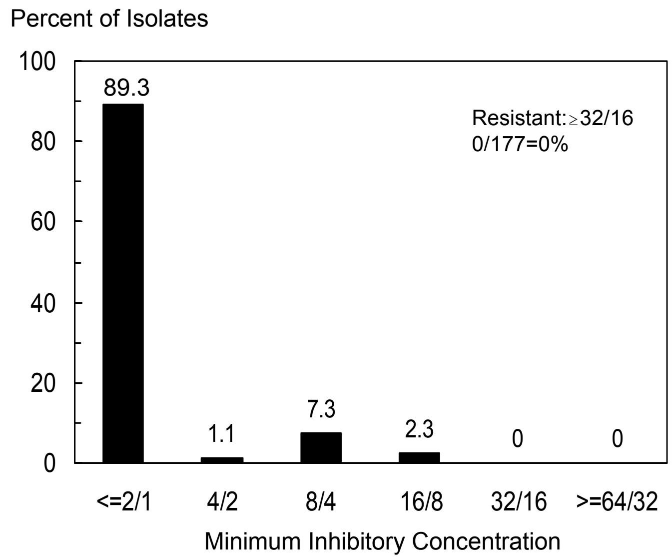
Figure 12b. MICs for amoxicillin-clavulanic acid among *Salmonella* Typhi isolates, 1999-2001

1999 (N=166)



2000 (N=177)



2001 (N=197)

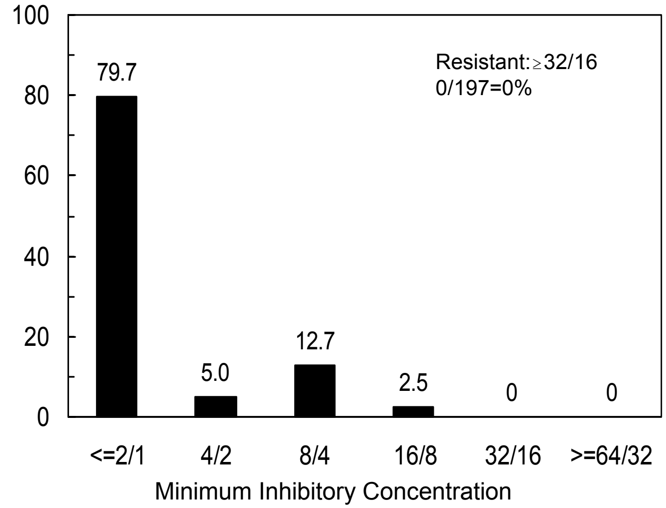


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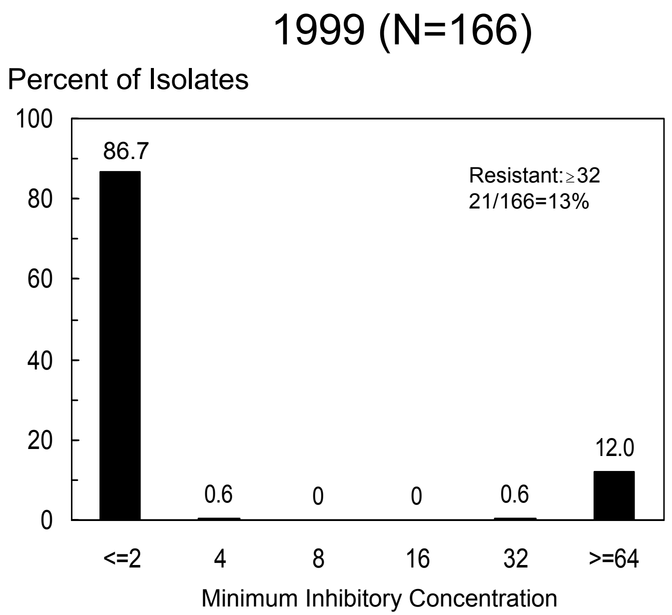
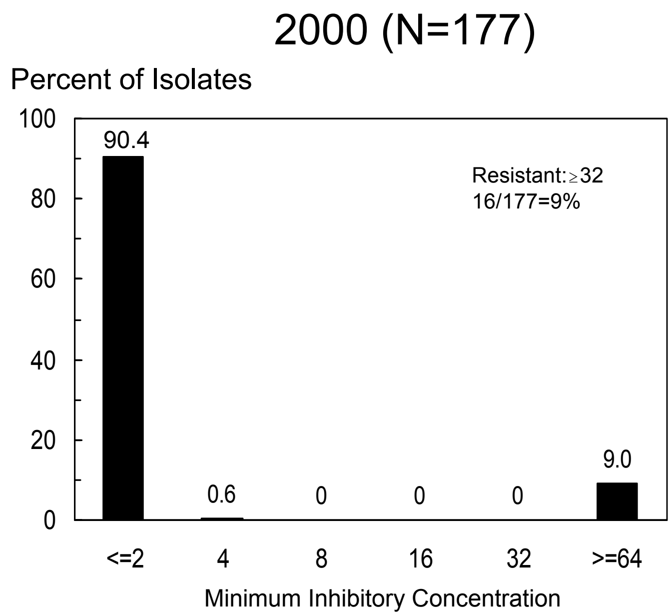
Figure 12c. MICs for ampicillin among *Salmonella* Typhi isolates, 1999-2001





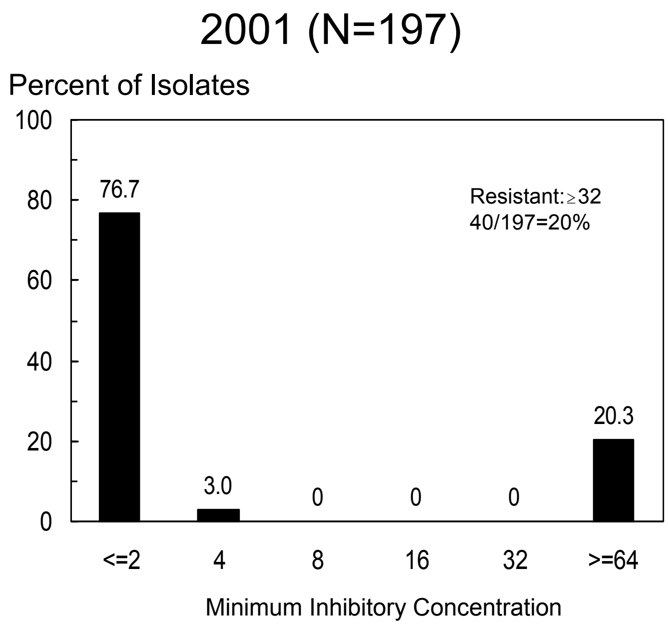
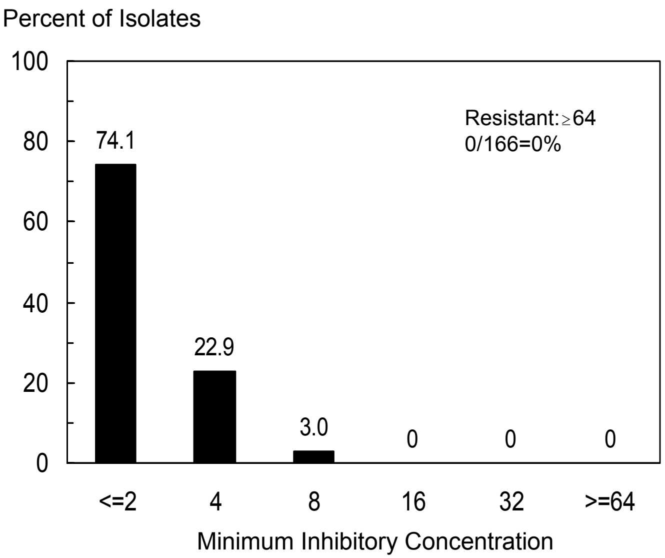
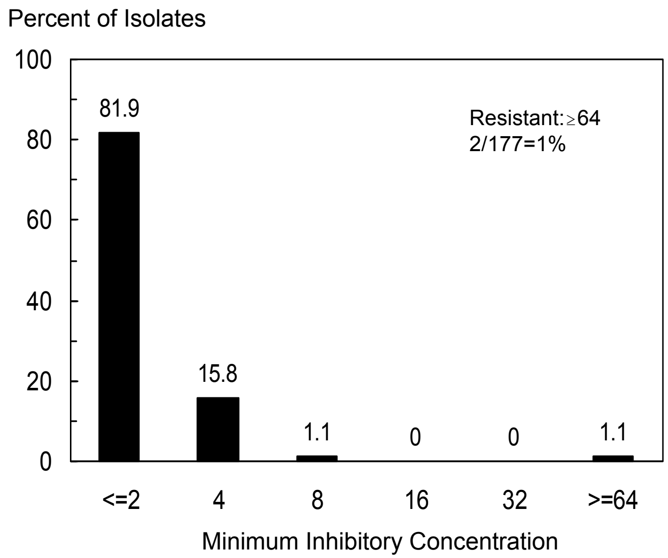


Figure 12d. MICs for apramycin among *Salmonella* Typhi isolates, 1999-2001

1999 (N=166)



2000 (N=177)



2001 (N=197)

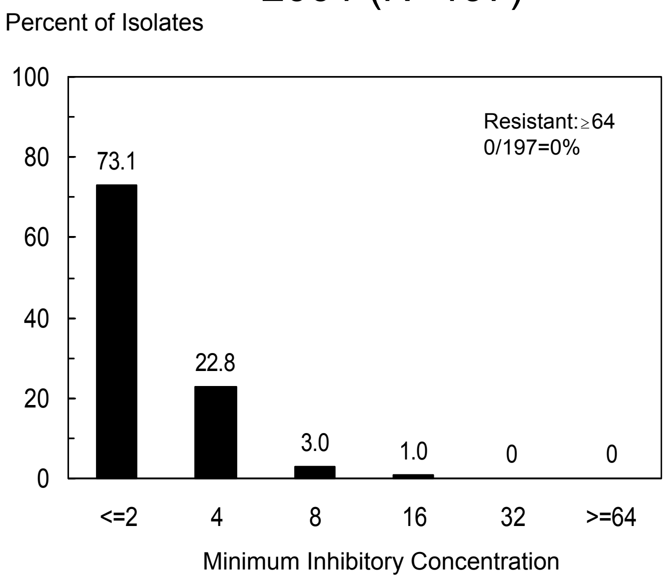


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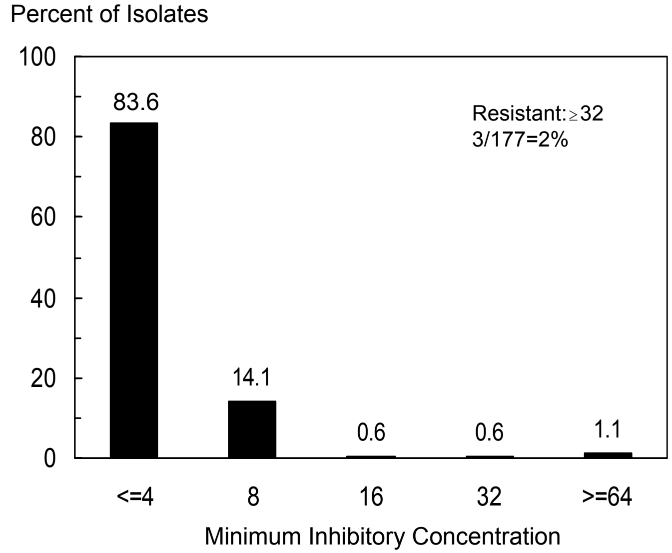
Figure 12e. MICs for cefoxitin among *Salmonella* Typhi isolates, 1999-2001

Not Tested in 1999

2000 (N=177)



2001 (N=197)

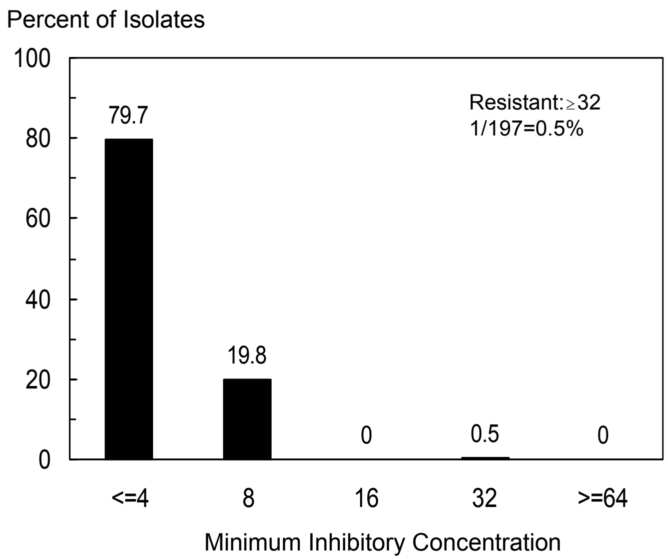


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Figure 12f. MICs for ceftiofur among *Salmonella* Typhi isolates, 1999-2001

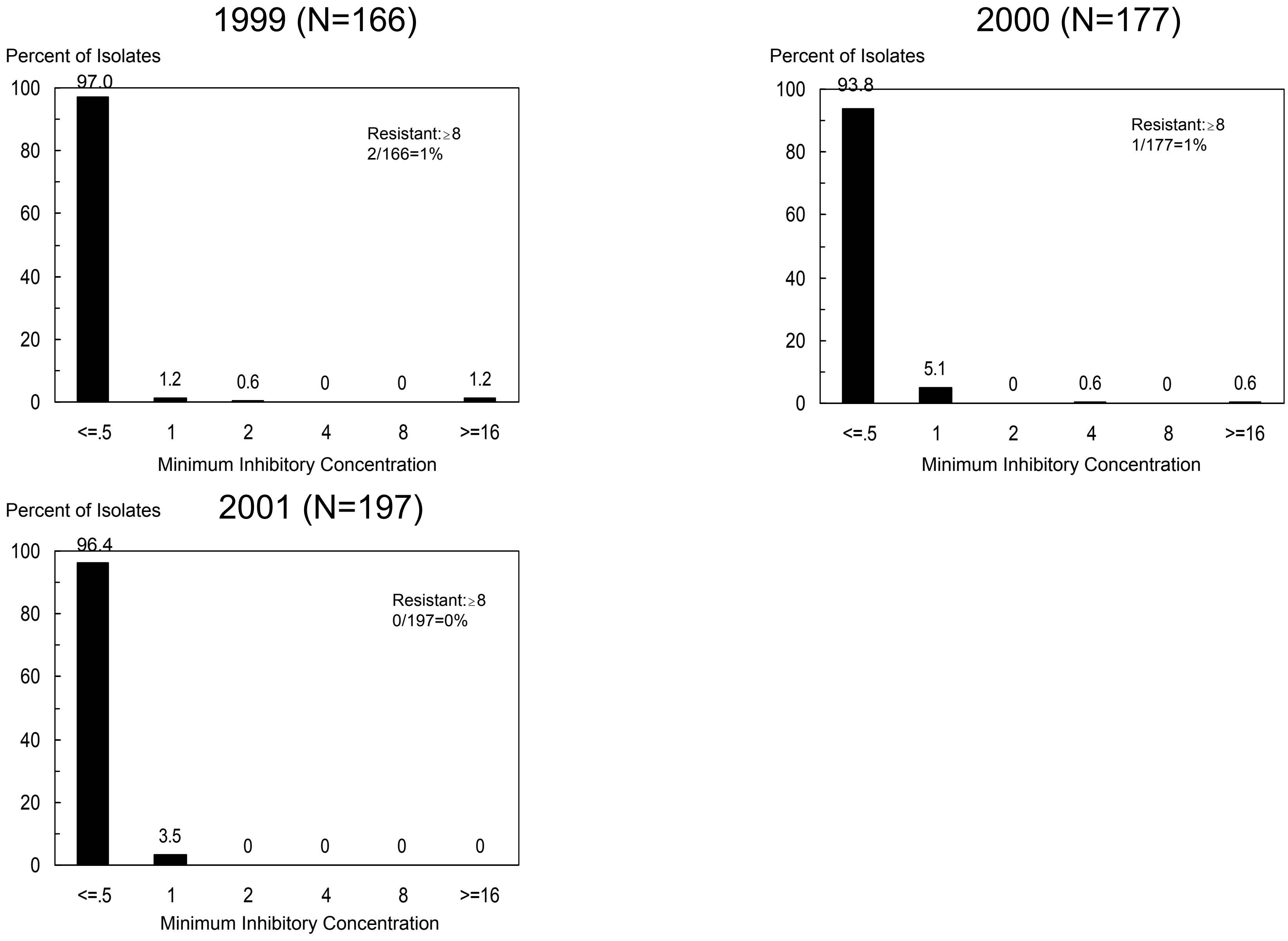

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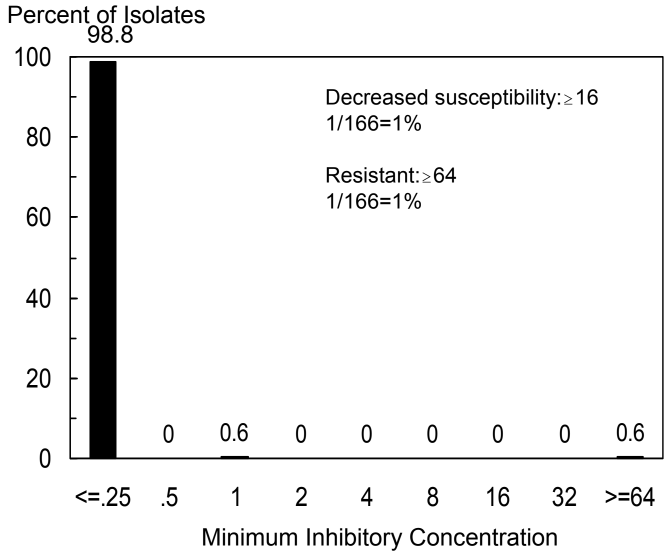
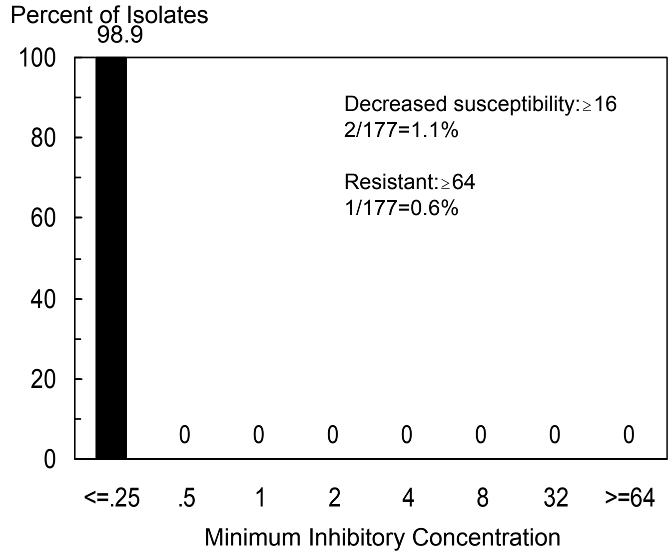
Figure 12g. MICs for ceftriaxone* among *Salmonella* Typhi isolates, 1999-2001

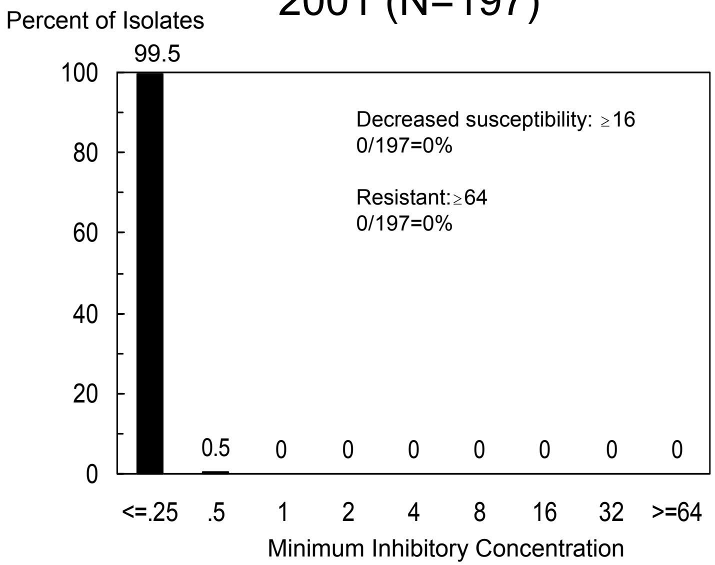
1999 (N=166)



2000 (N=177)



2001 (N=197)



*Sensititre® results only

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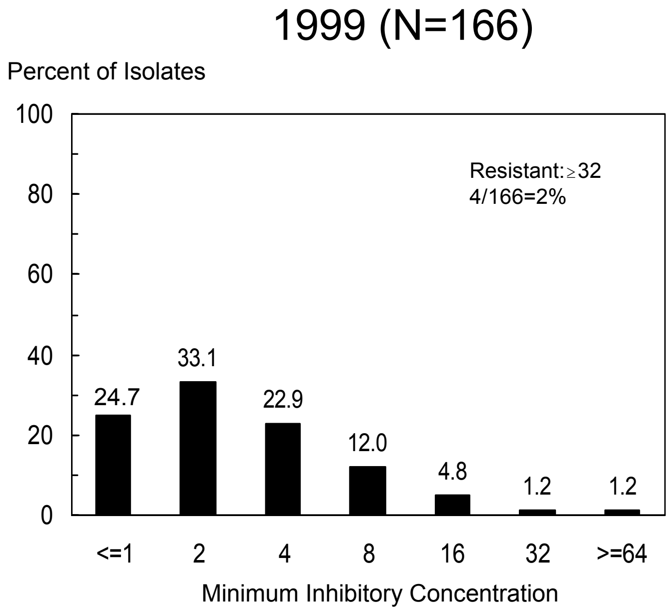
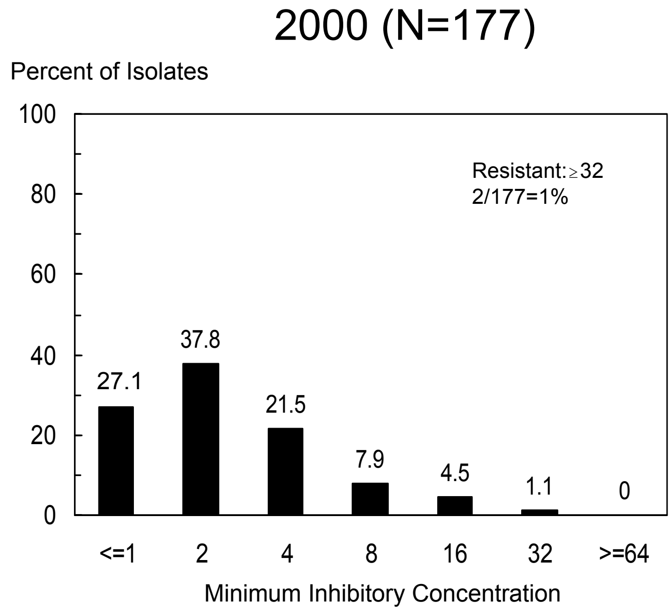
Figure 12h. MICs for cephalothin among *Salmonella* Typhi isolates, 1999-2001





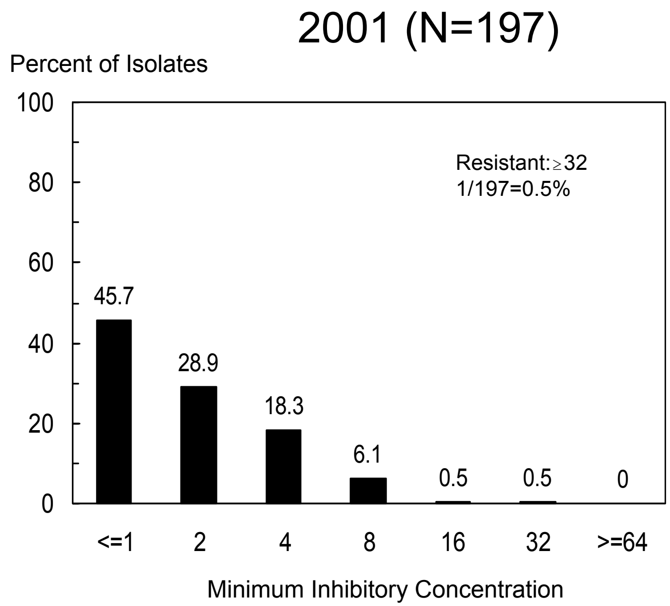


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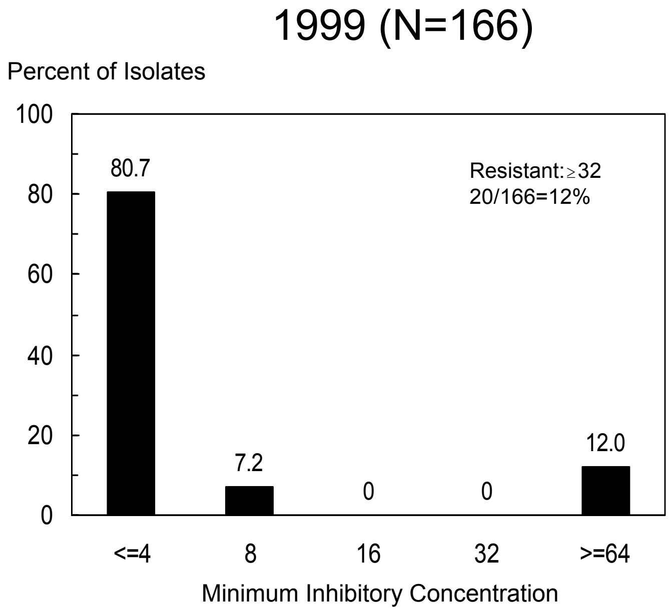
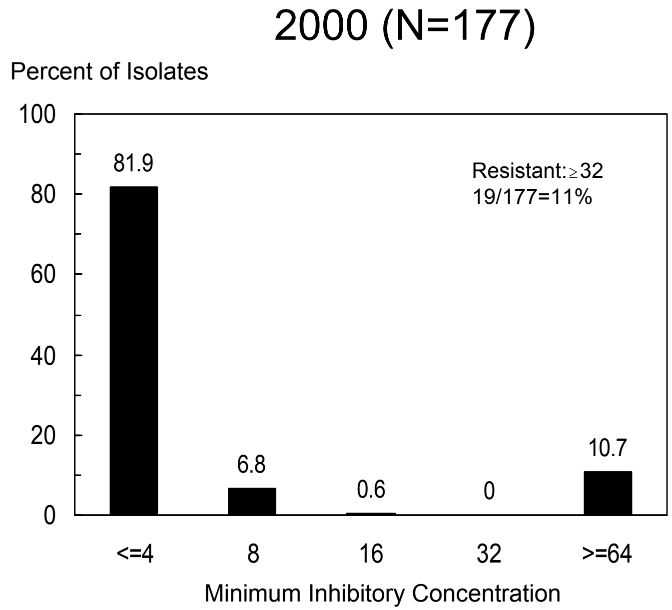
Figure 12i. MICs for chloramphenicol among *Salmonella* Typhi Isolates, 1999-2001





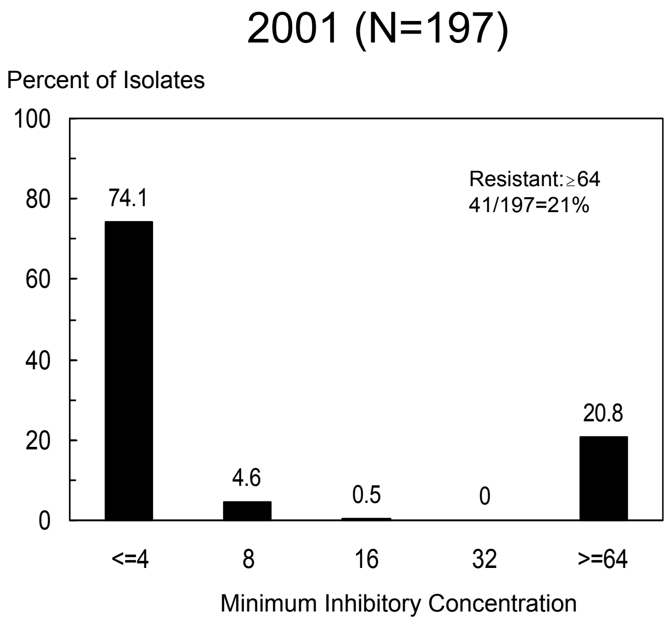


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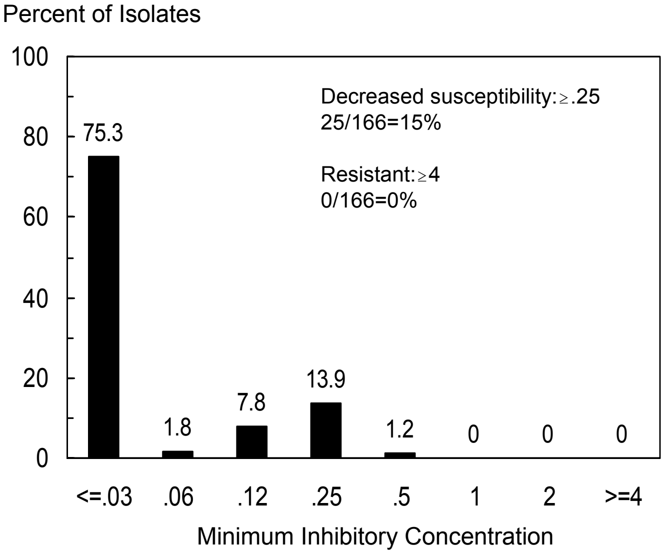
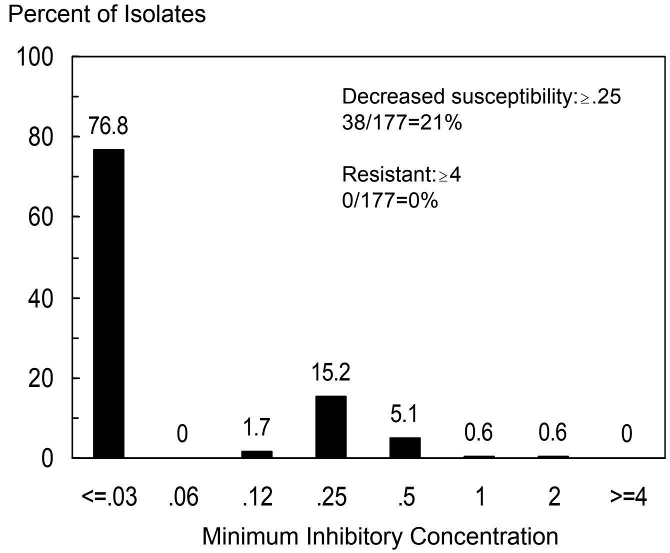
Figure 12j. MICs for ciprofloxacin among *Salmonella* Typhi isolates, 1999-2001

1999 (N=166)



2000 (N=177)



2001 (N=197)

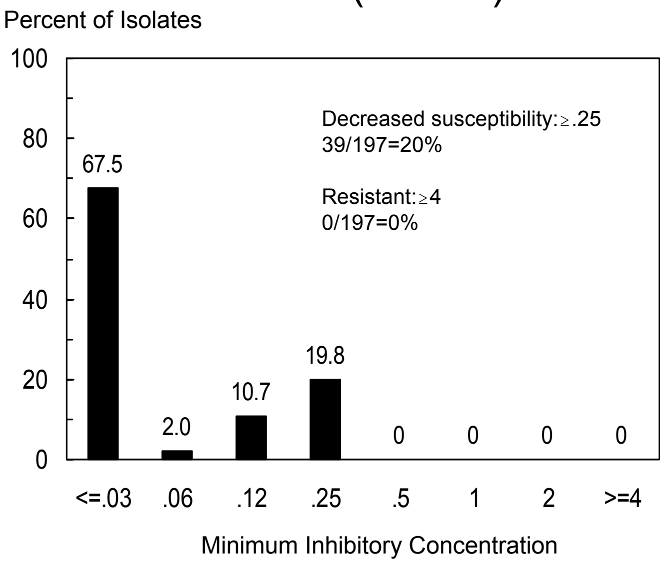


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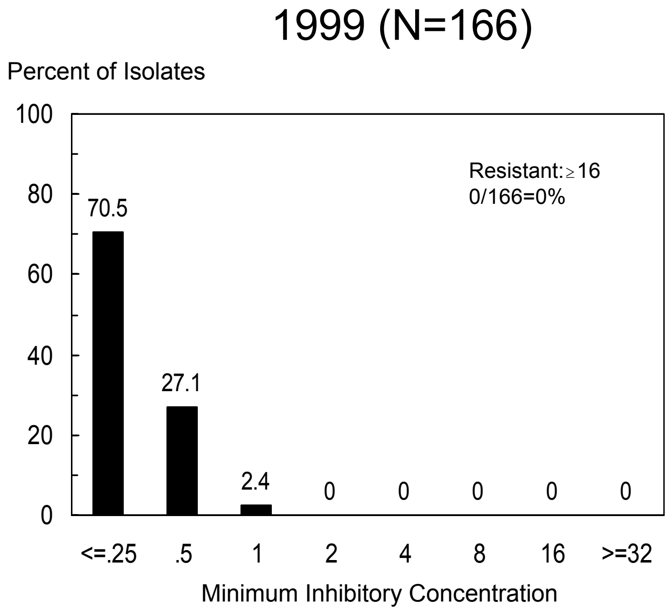
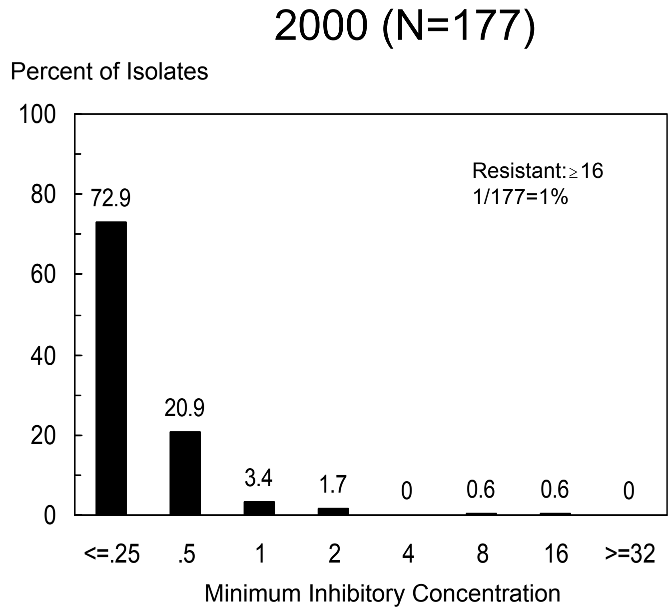
Figure 12k. MICs for gentamicin among *Salmonella* Typhi isolates, 1999-2001





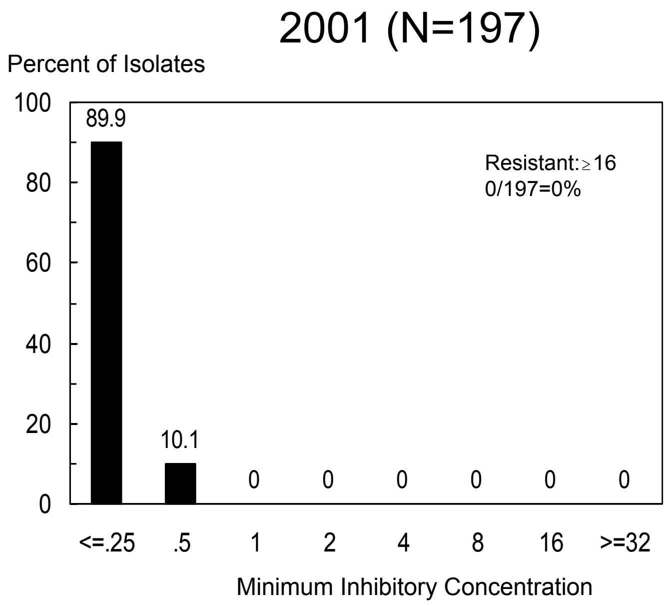


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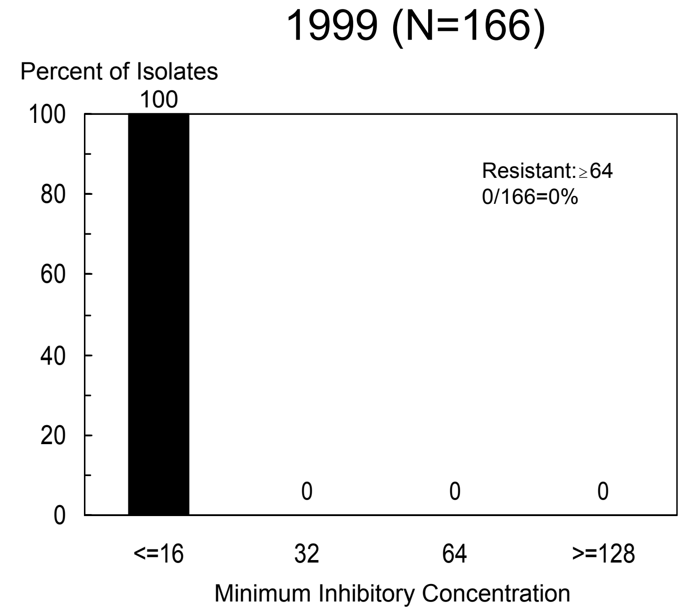
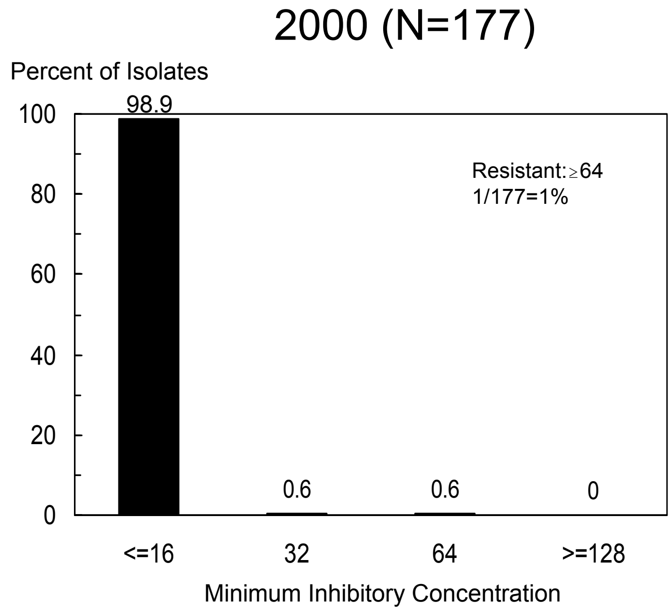
Figure 12l. MICs for kanamycin among *Salmonella* Typhi isolates, 1999-2001





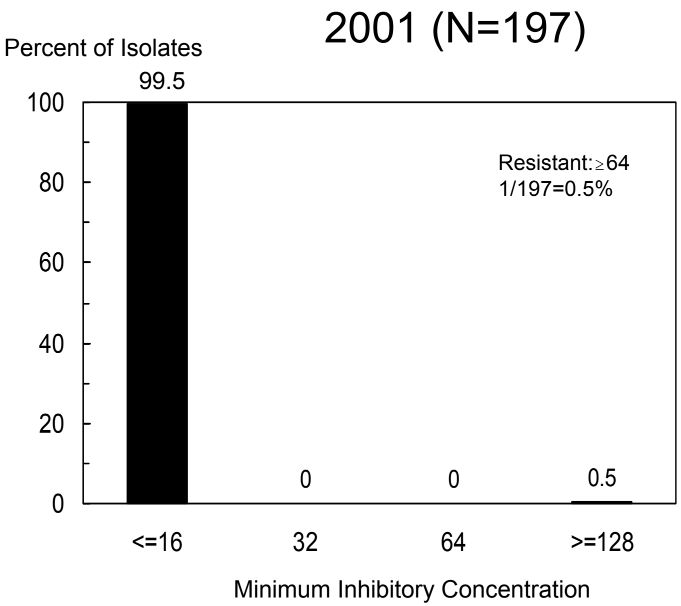
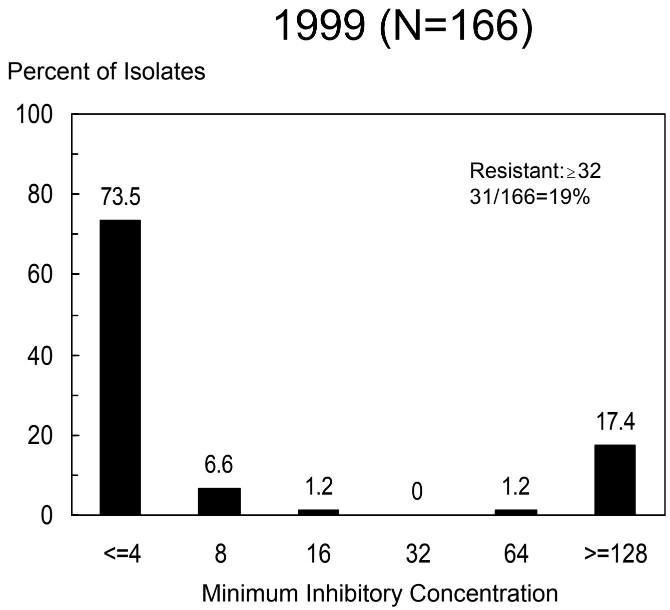
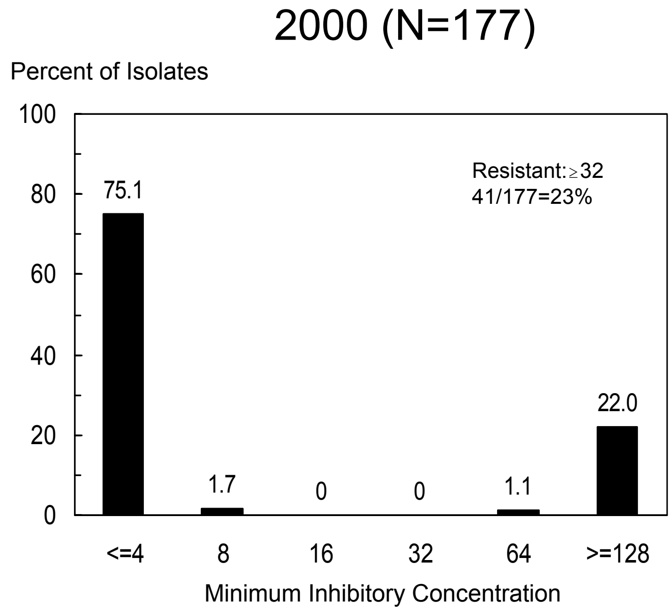


Figure 12m. MICs for nalidixic acid among *Salmonella* Typhi isolates, 1999-2001





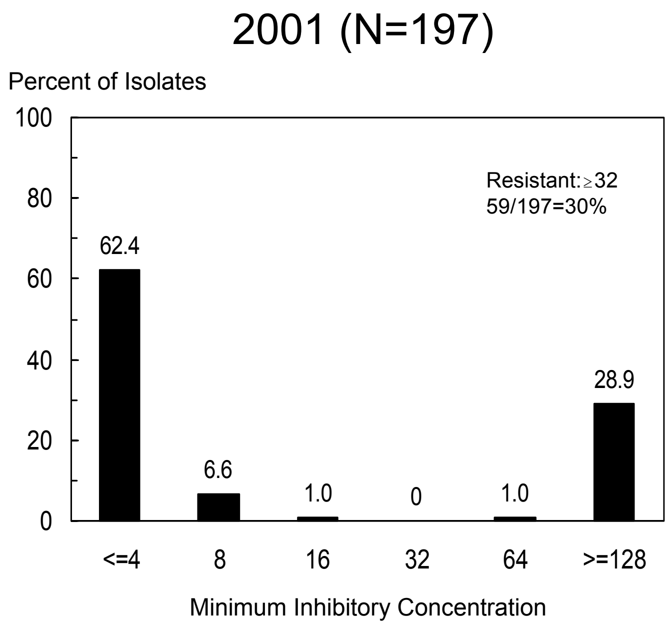


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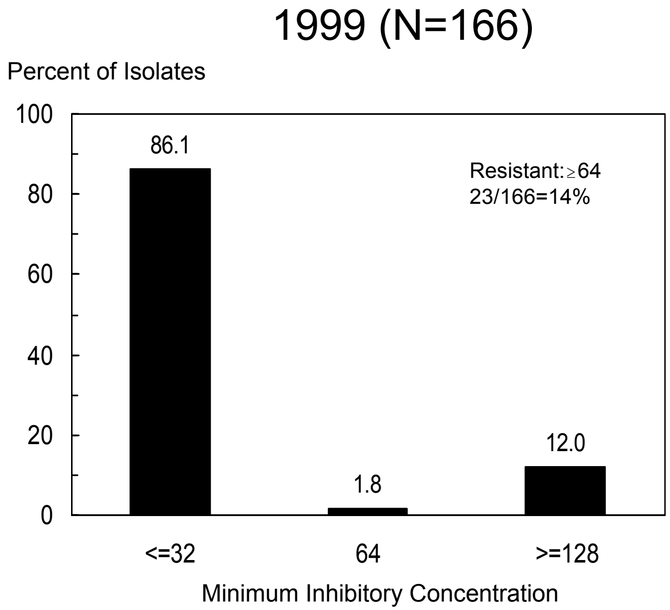
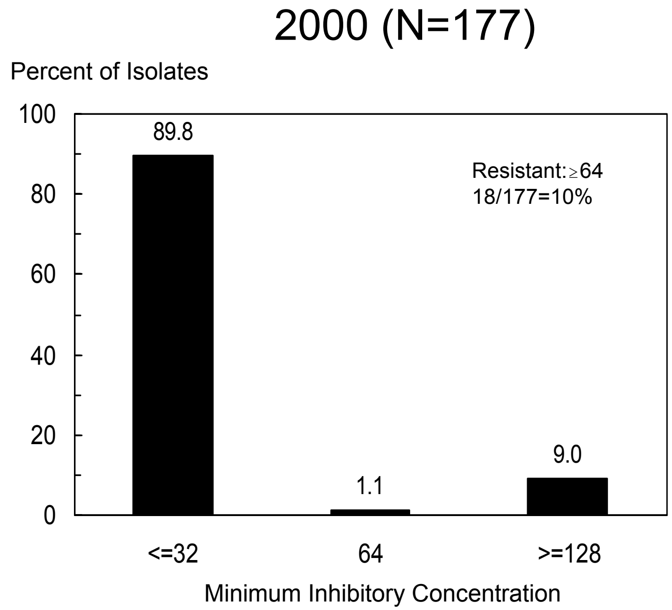
Figure 12n. MICs for streptomycin among *Salmonella* Typhi isolates, 1999-2001





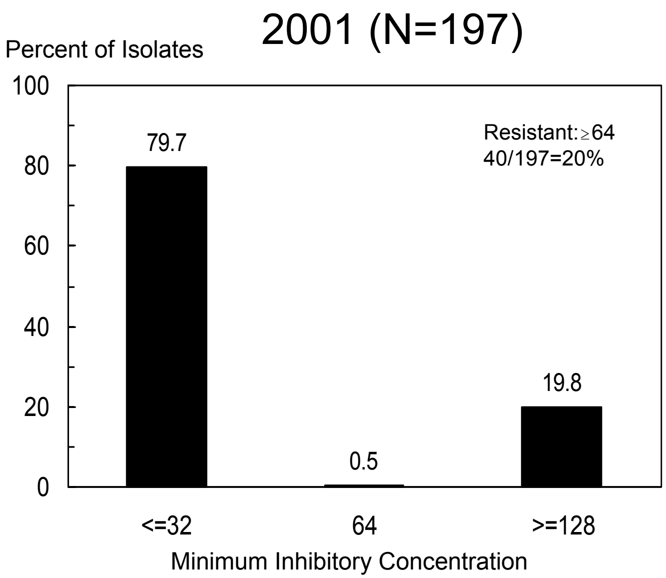


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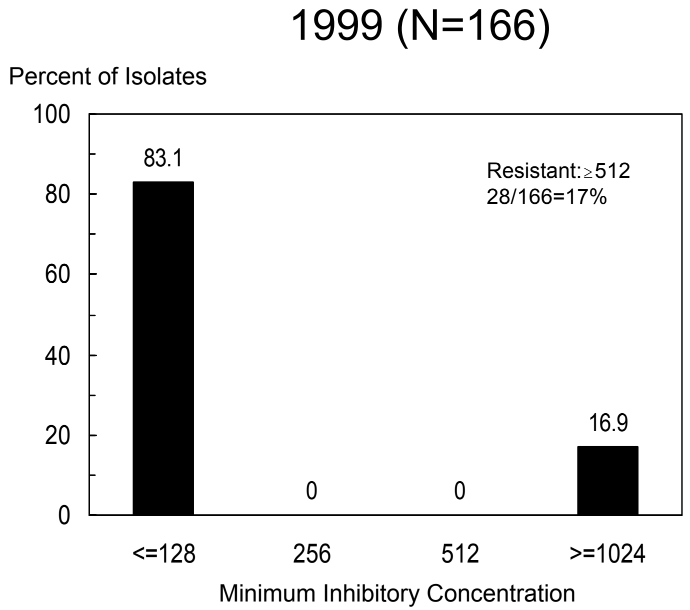
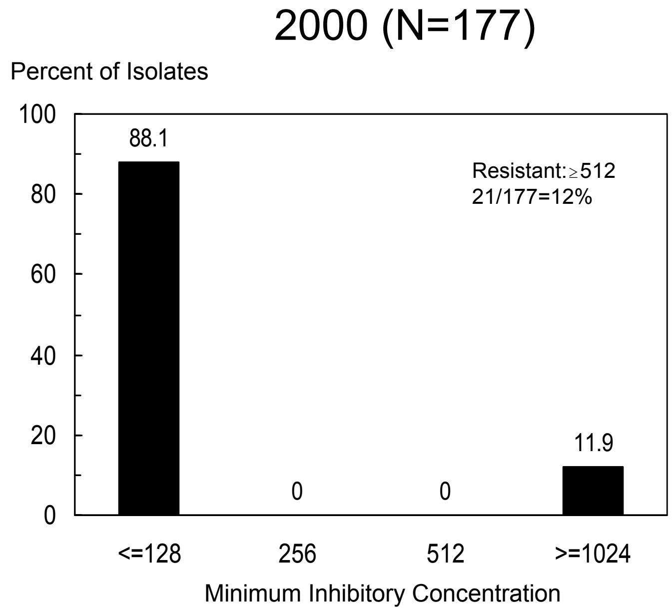
Figure 12o. MICs for sulfamethoxazole among *Salmonella* Typhi isolates, 1999-2001





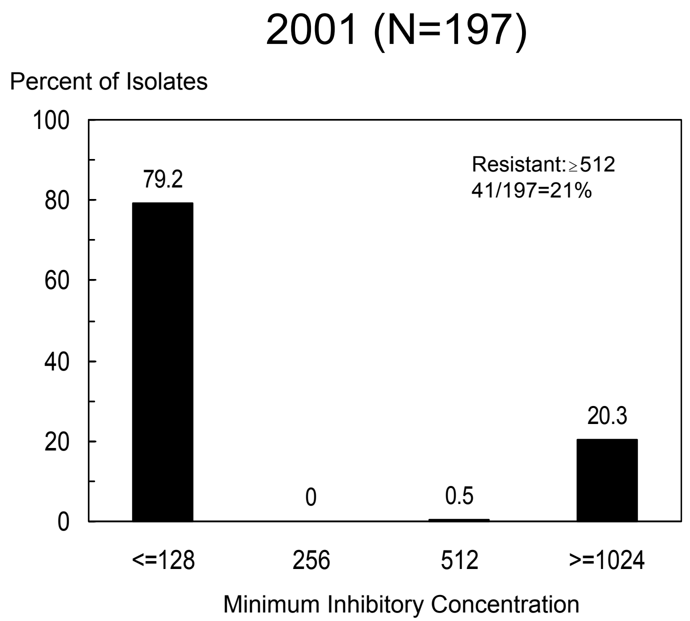


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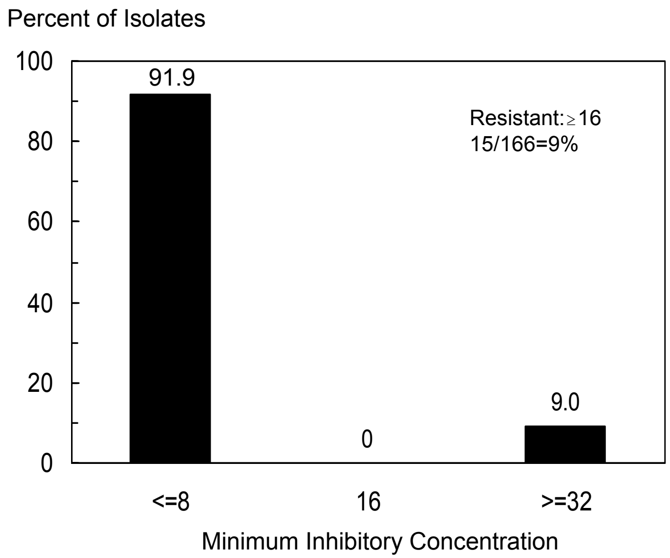
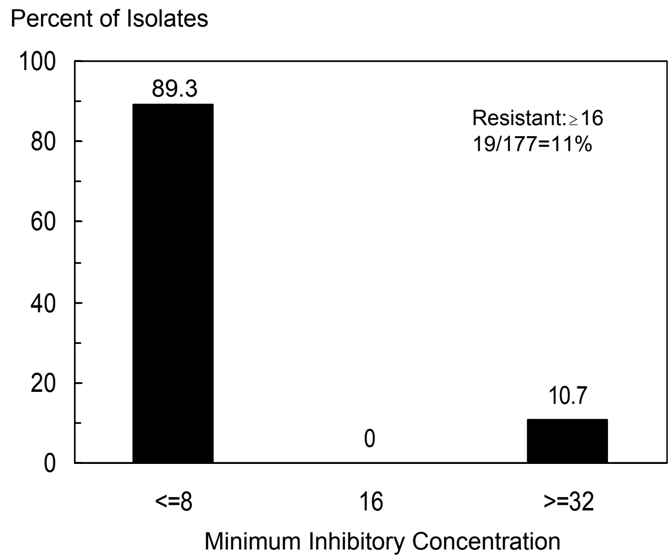
Figure 12p. MICs for tetracycline among *Salmonella* Typhi isolates, 1999-2001

1999 (N=166)



2000 (N=177)



2001 (N=197)

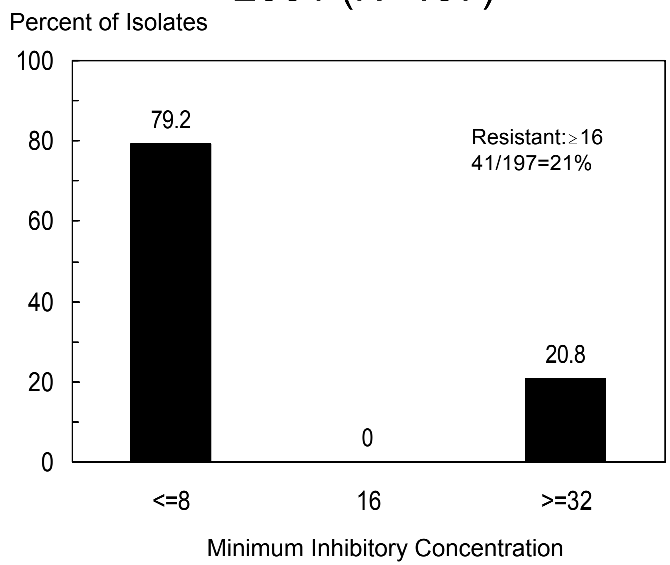


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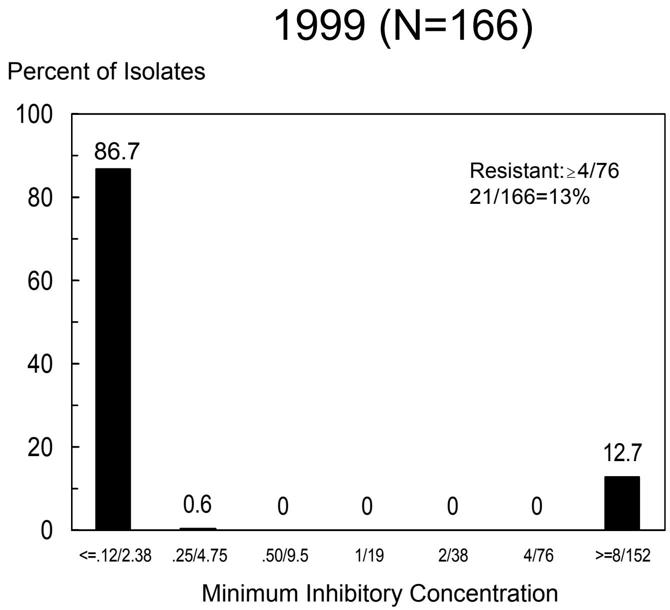
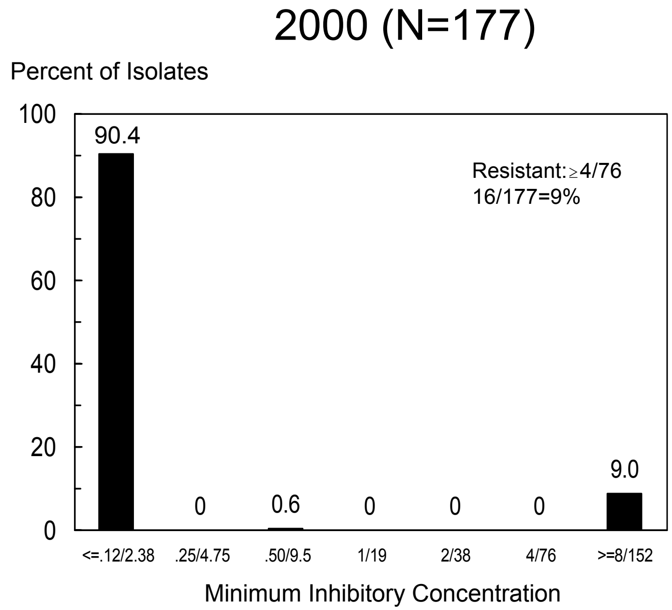
Figure 12q. MICs for trimethoprim-sulfamethoxazole among *Salmonella* Typhi isolates, 1999 - 2001





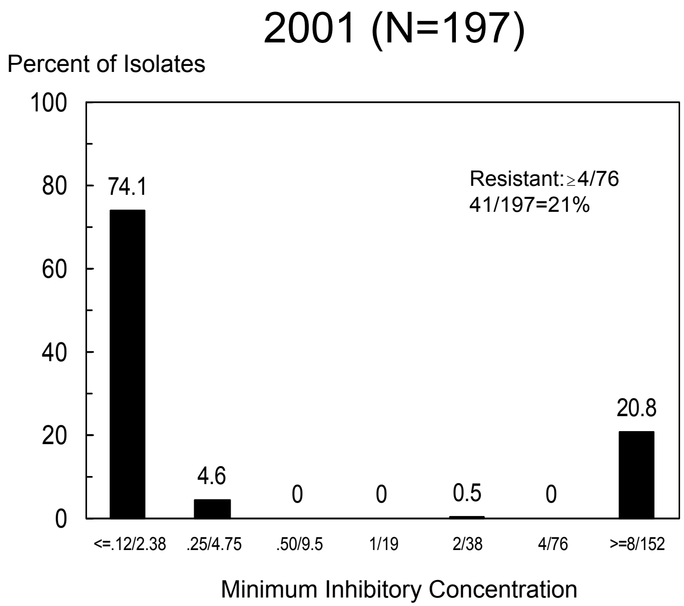


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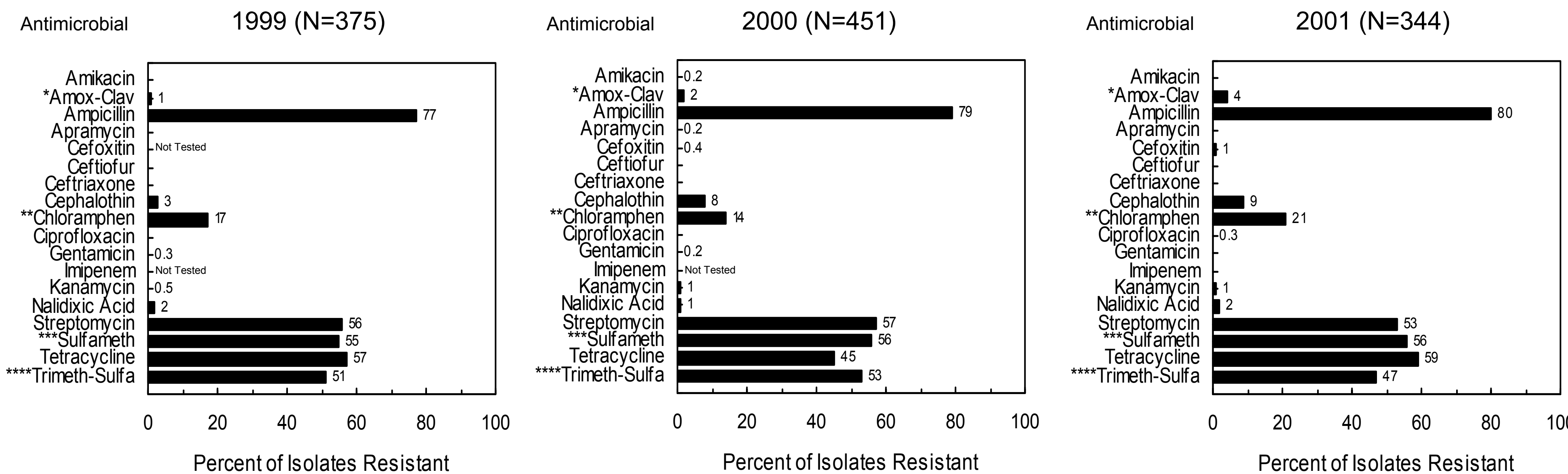
Figure 13. Resistance among *Shigella* isolates, 1999-2001



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

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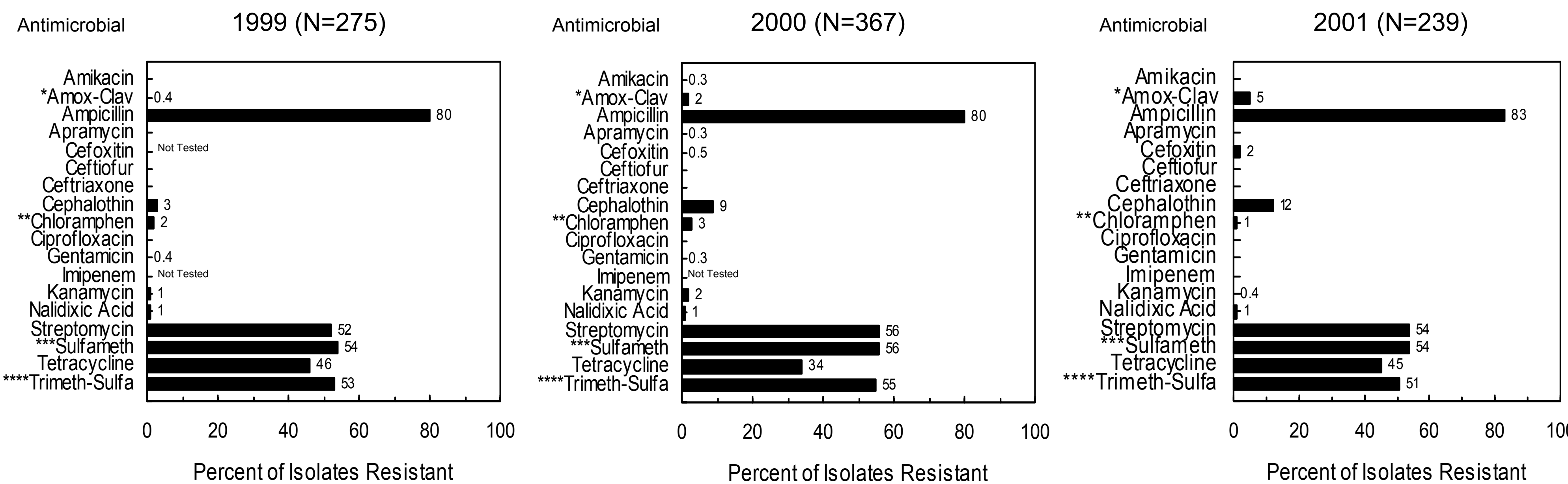
Figure 14a. Resistance among *Shigella sonnei* isolates, 1999-2001



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

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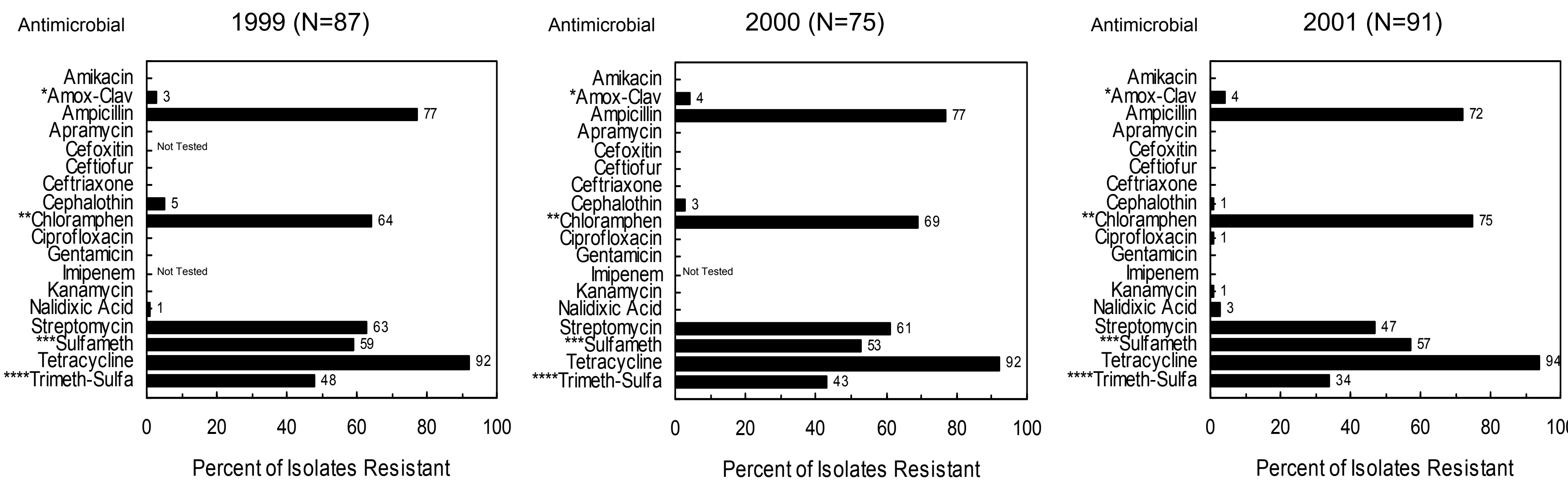
Figure 14b. Resistance among *Shigella flexneri* isolates, 1999-2001



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

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Figure 15a. MICs for amikacin among *Shigella sonnei* isolates, 1999-2001

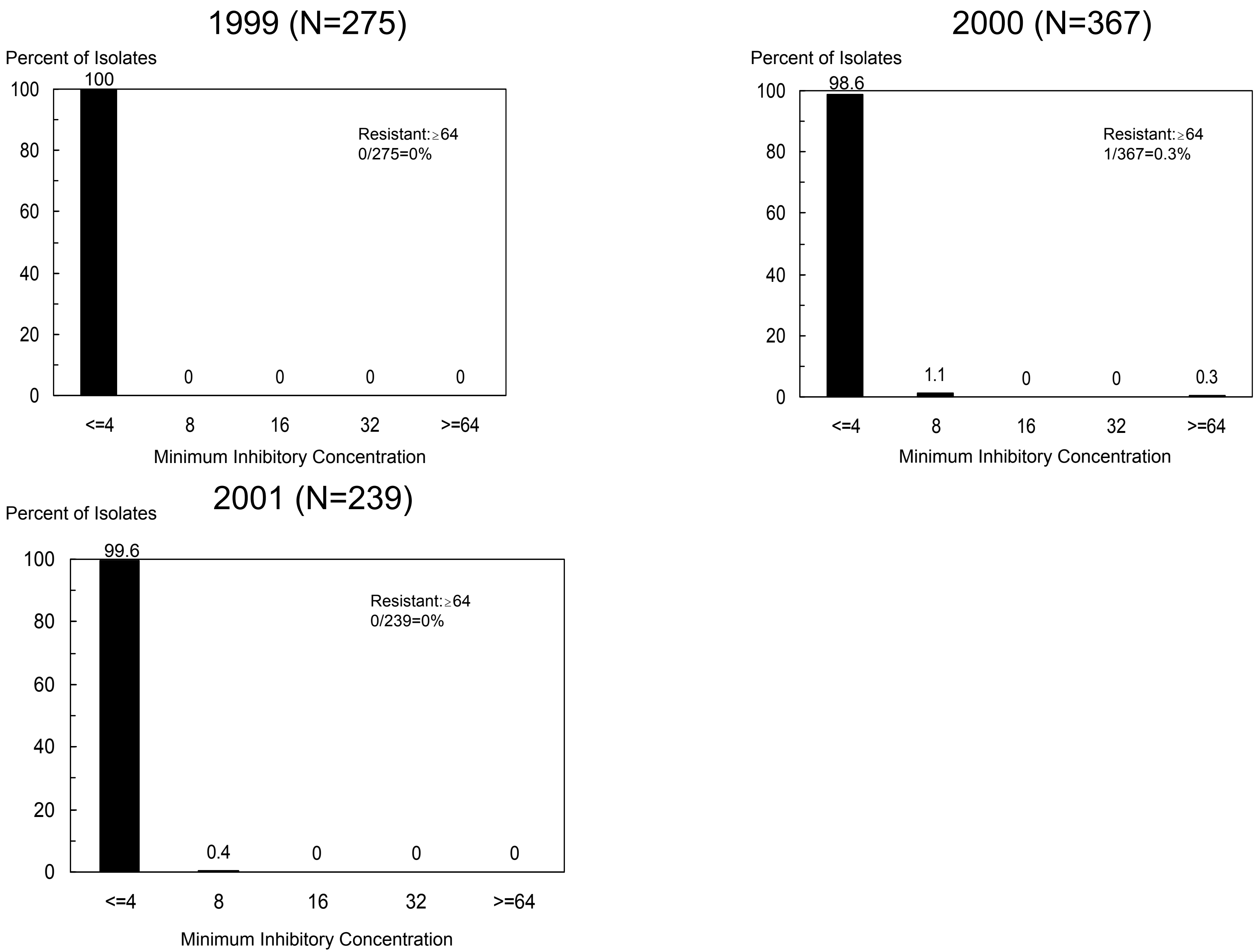

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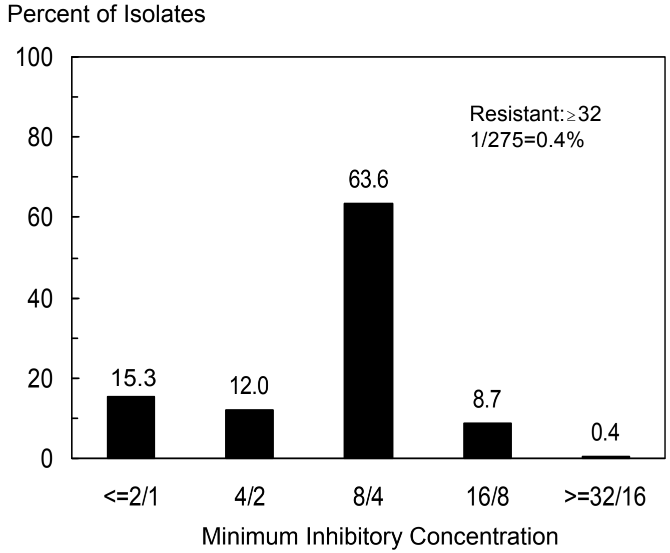
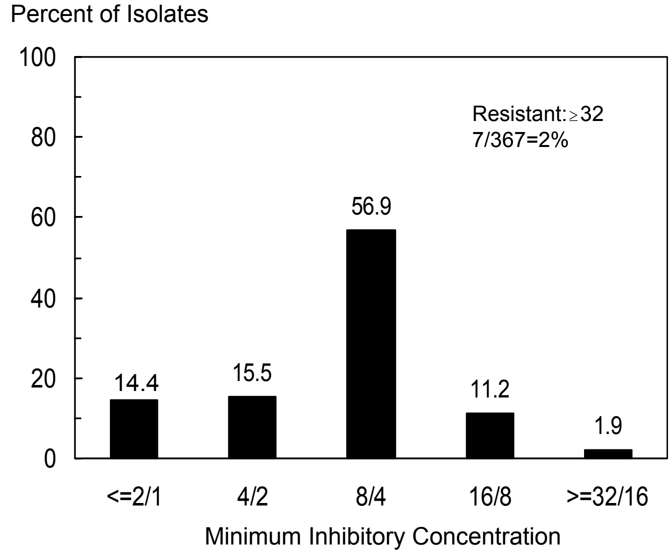
Figure 15b. MICs for amoxicillin-clavulanic acid among *Shigella sonnei* isolates, 1999-2001

1999 (N=275)



2000 (N=367)



2001 (N=239)

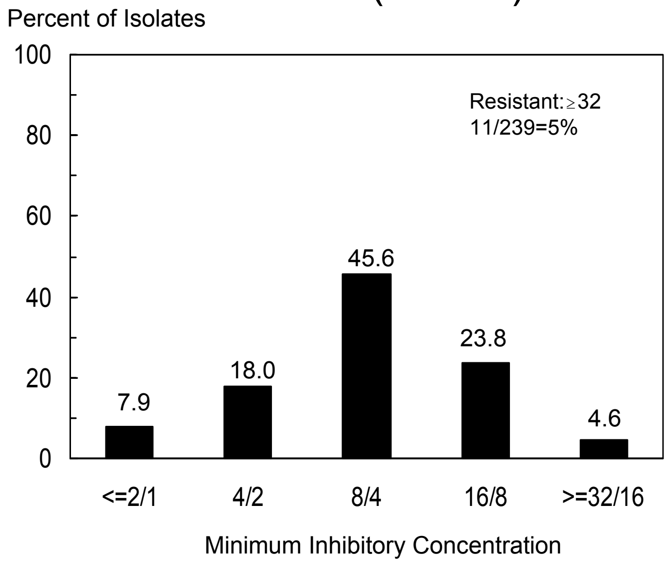


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Figure 15c. MICs for ampicillin among *Shigella sonnei* isolates, 1999-2001

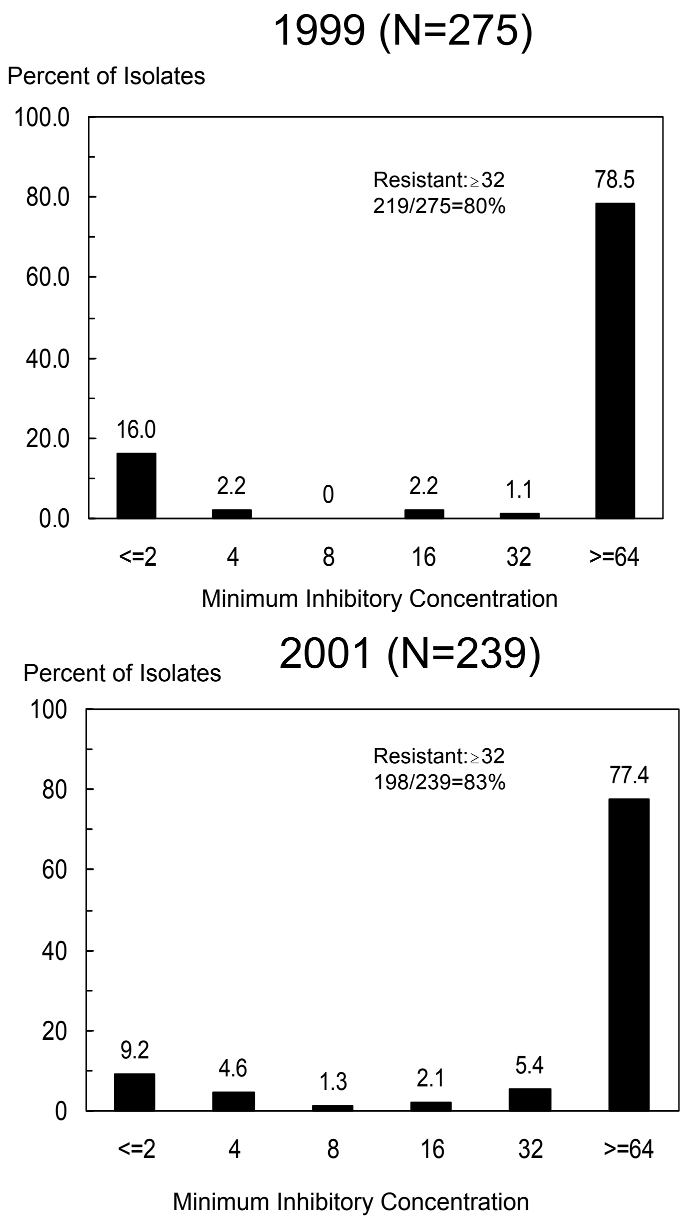

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Figure 15d. MICs for apramycin among *Shigella sonnei* isolates, 1999-2001

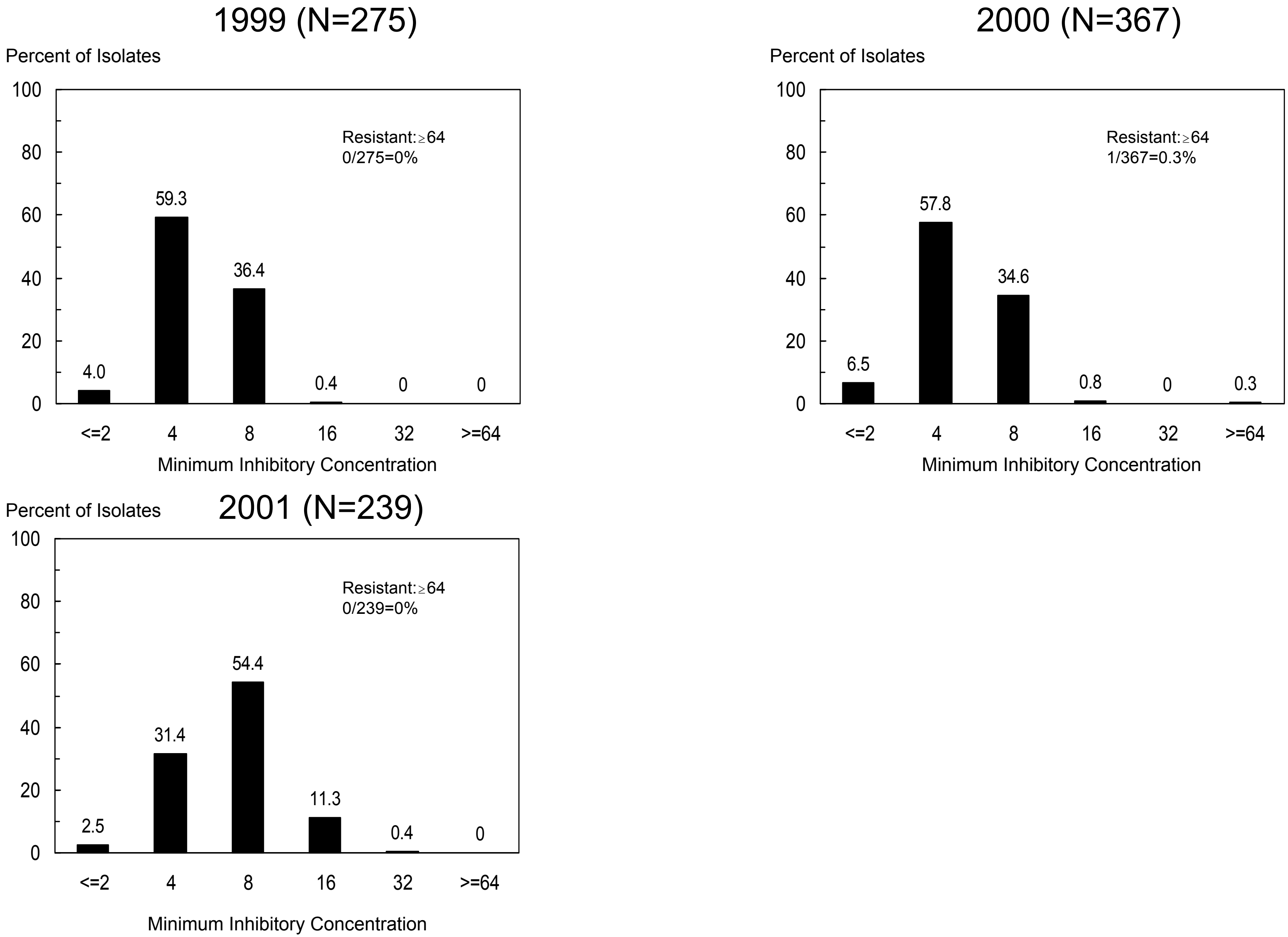

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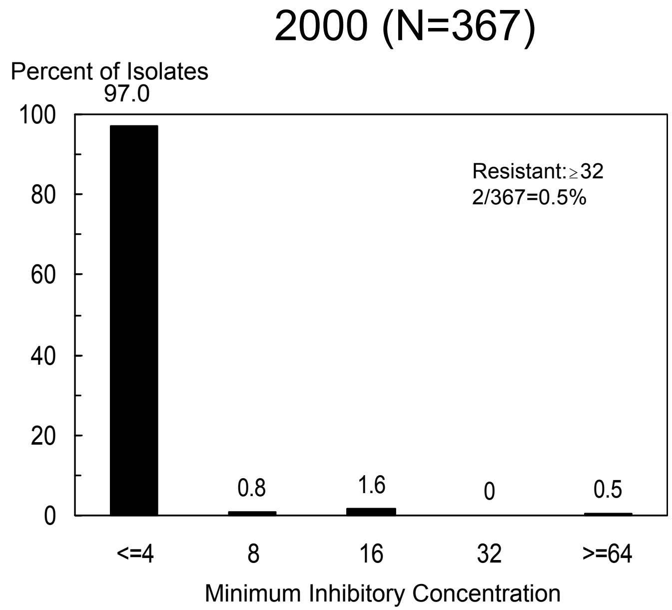
Figure 15e. MICs for cefoxitin among *Shigella sonnei* isolates, 1999-2001

Not Tested in 1999



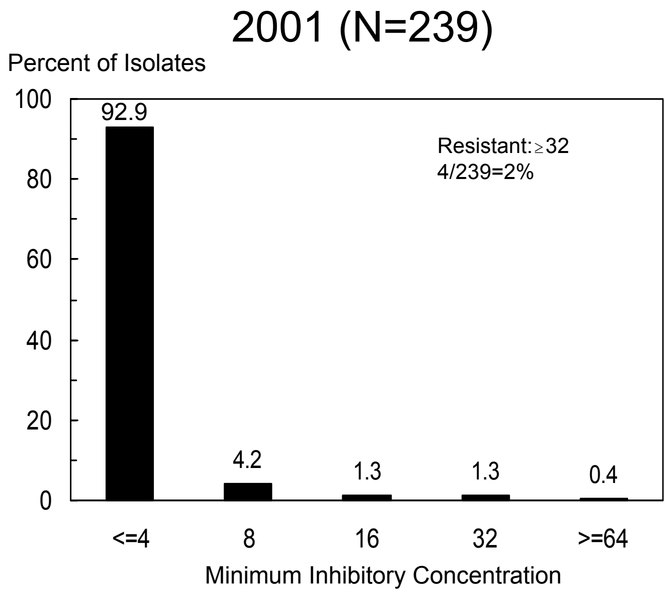


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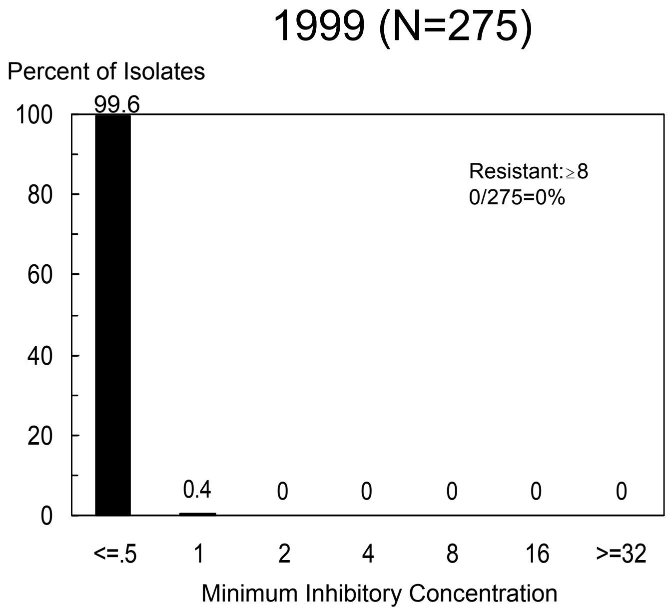
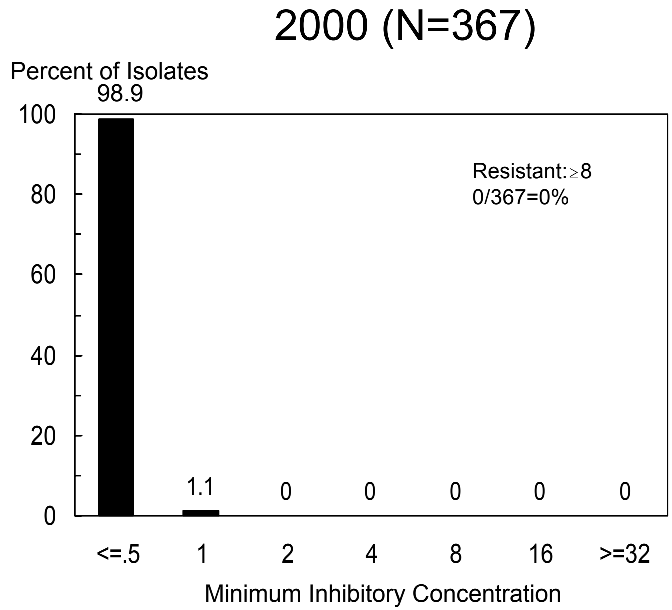
Figure 15f. MICs for ceftiofur among *Shigella sonnei* isolates, 1999-2001





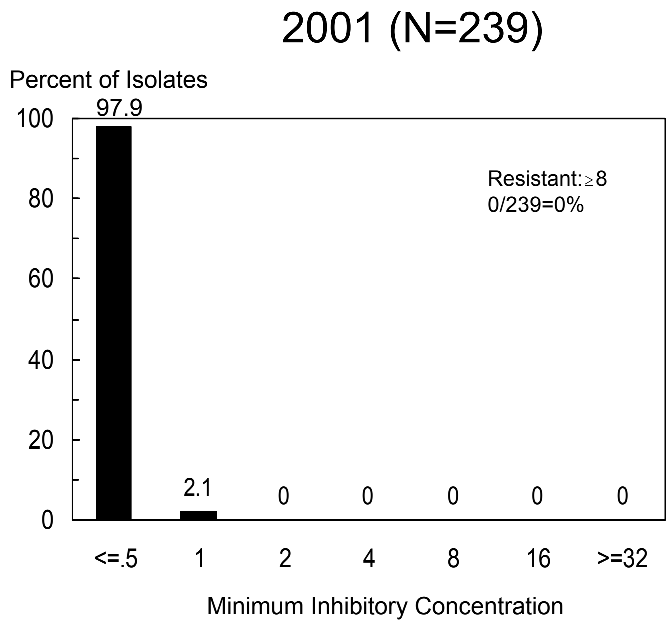


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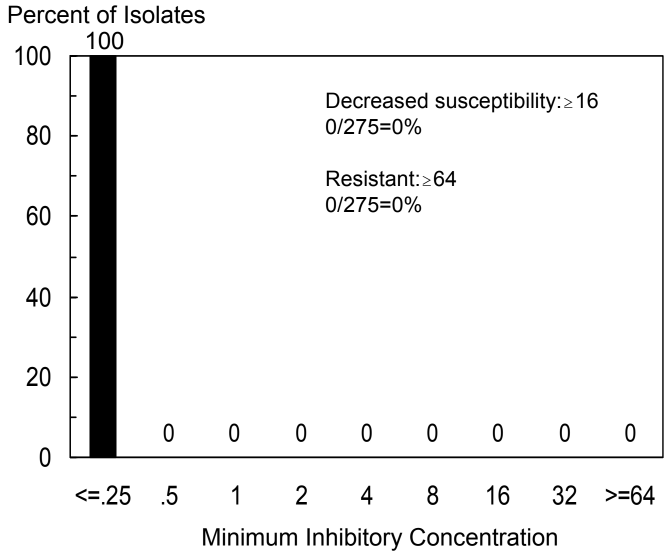
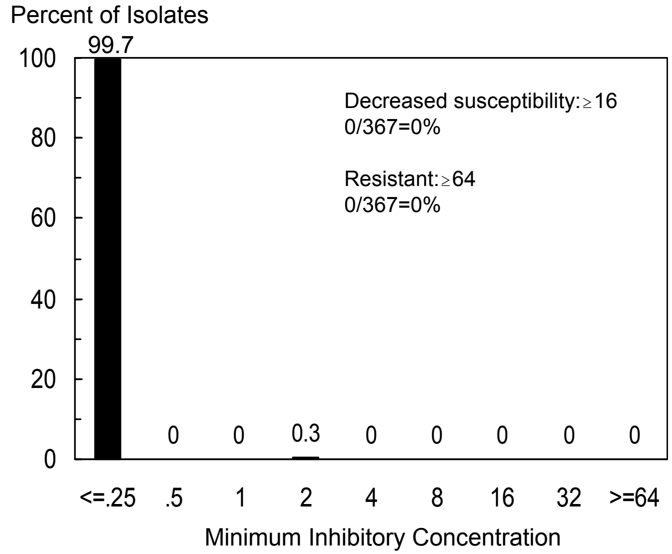
Figure 15g. MICs for ceftriaxone* among *Shigella sonnei* isolates, 1999-2001

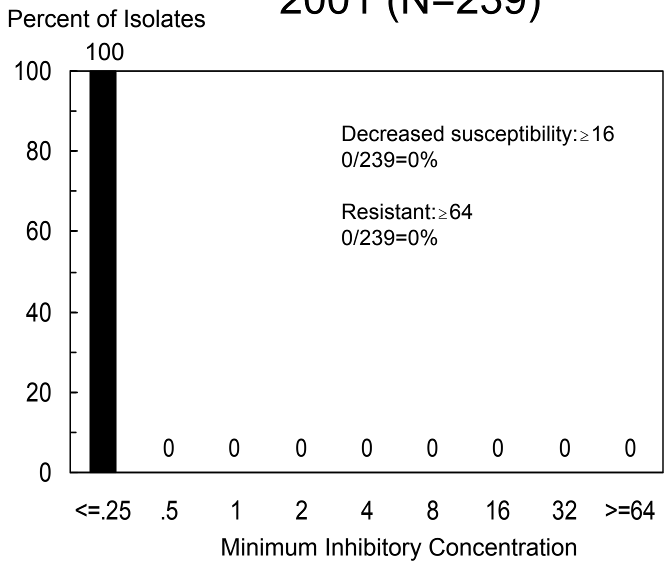
1999 (N=275)



2000 (N=367)



2001 (N=239)



*Sensititre® results only

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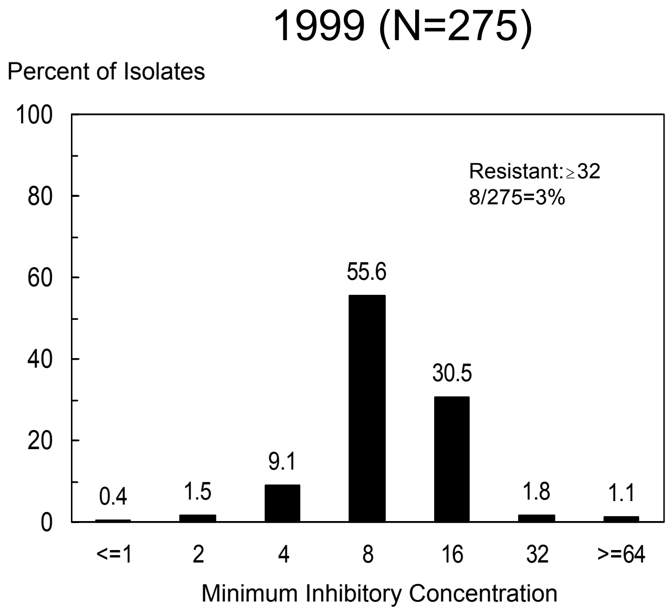
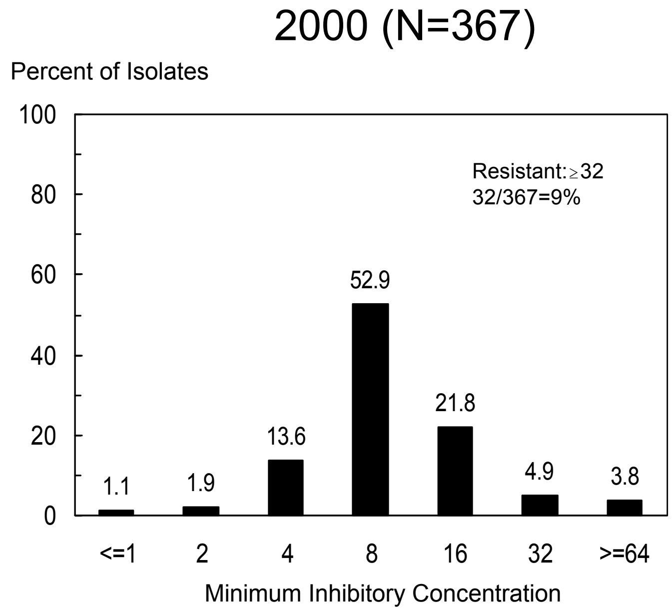
Figure 15h. MICs for cephalothin among *Shigella sonnei* isolates, 1999-2001





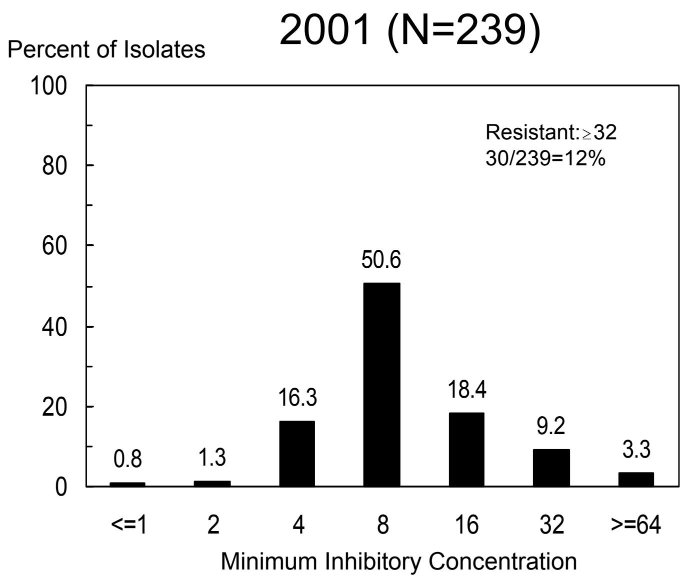


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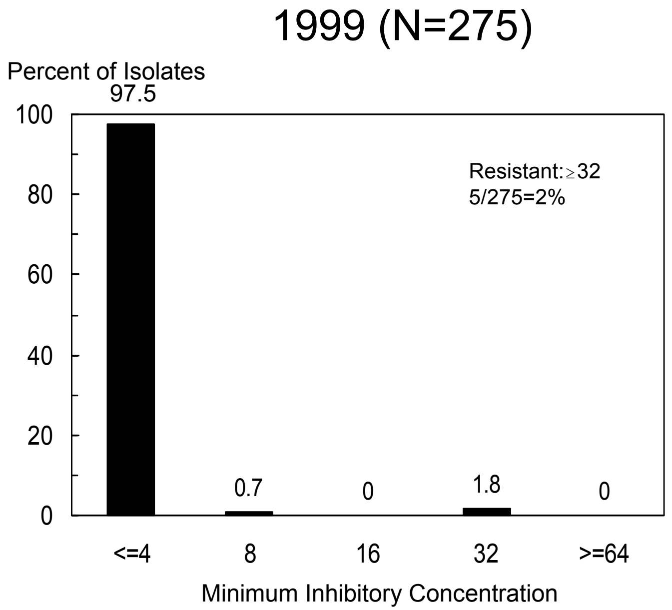
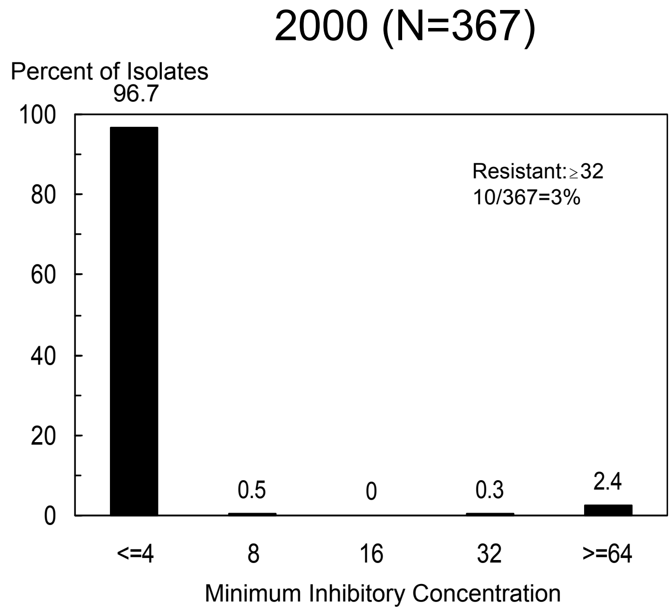
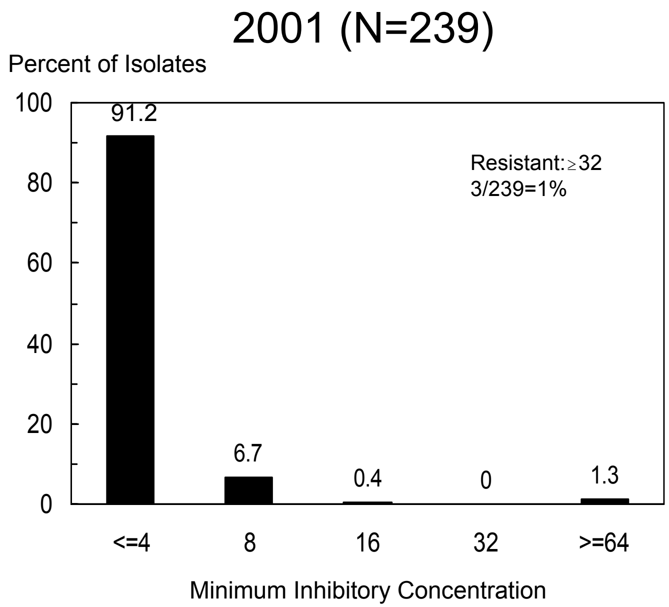
Figure 15i. MICs for chloramphenicol among *Shigella sonnei* isolates, 1999-2001

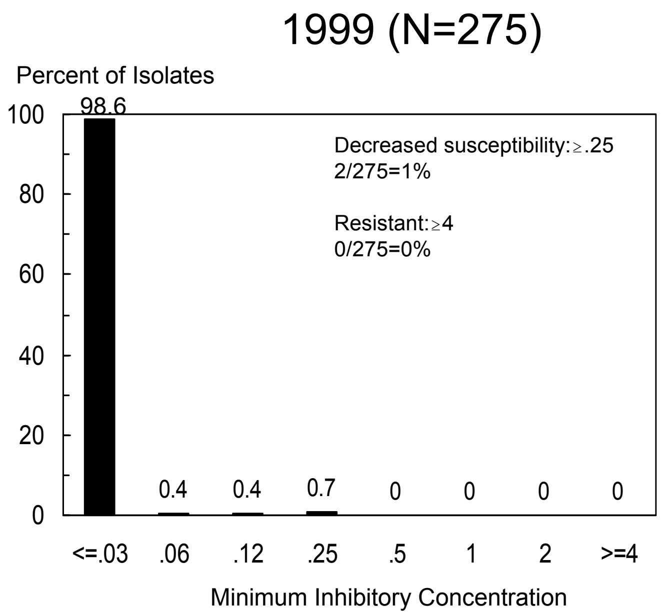


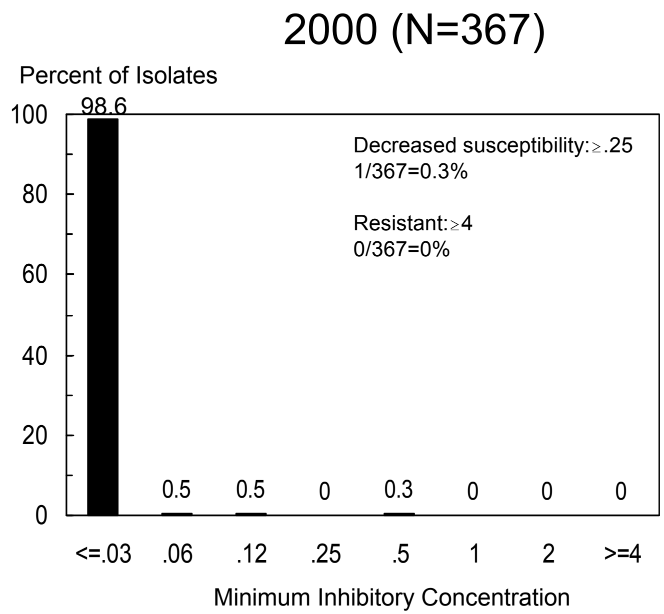




National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 15j. MICs for ciprofloxacin among *Shigella sonnei* isolates, 1999-2001





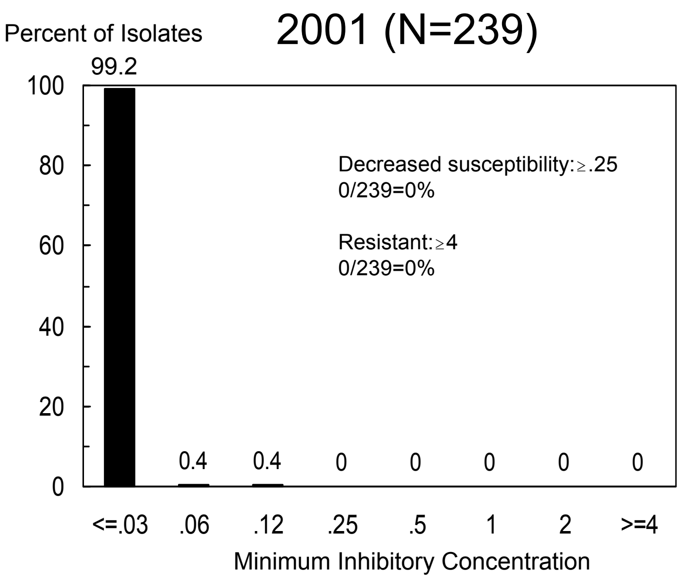


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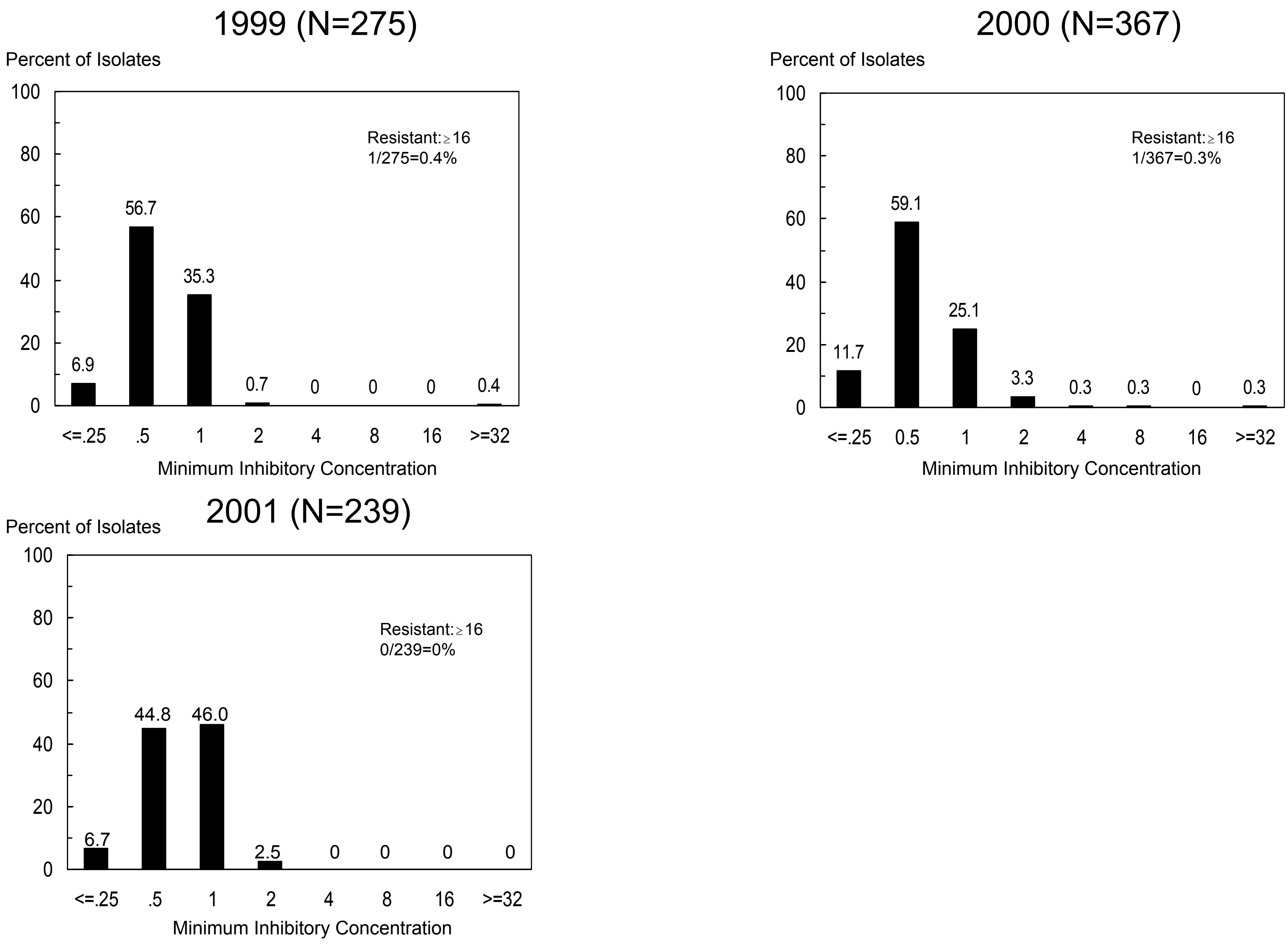
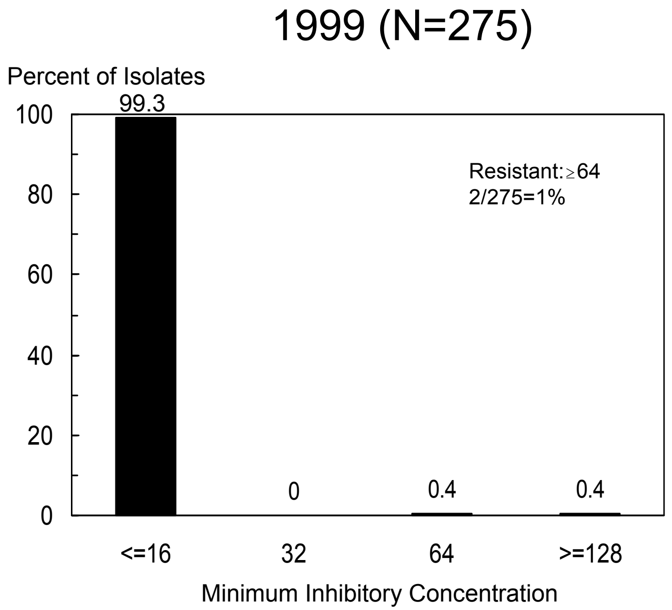
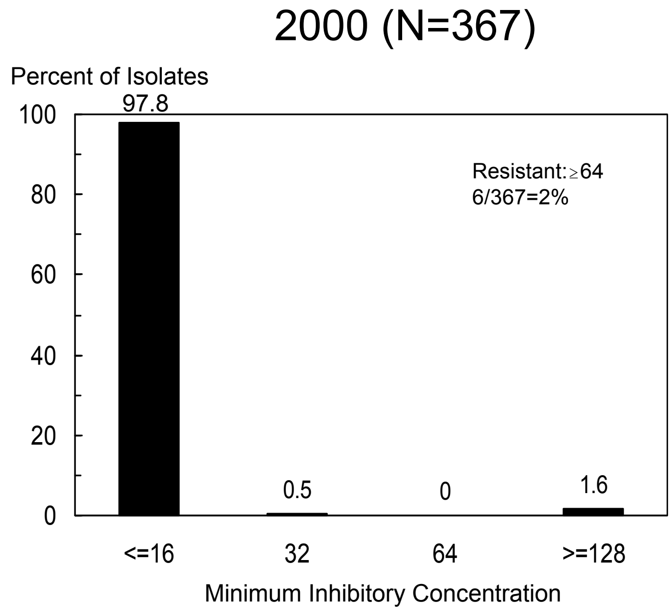
Figure 15k. MICs for gentamicin among *Shigella sonnei* isolates, 1999-2001

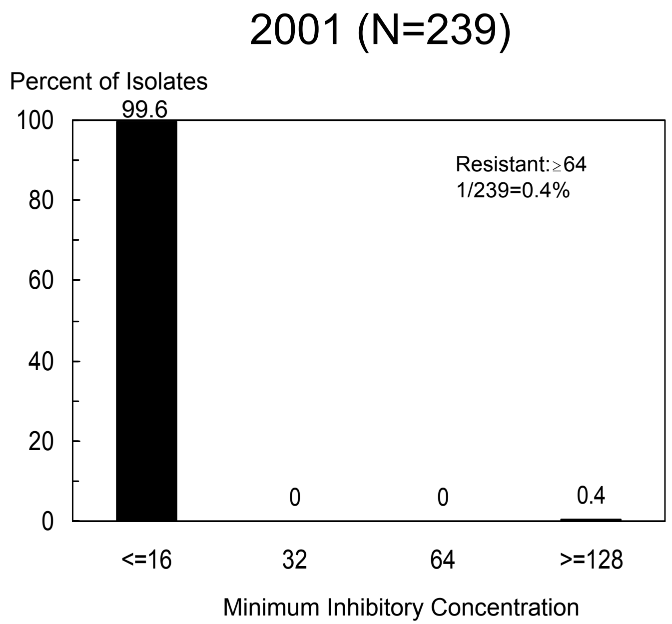


National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 15I. MICs for kanamycin among *Shigella sonnei* isolates, 1999-2001

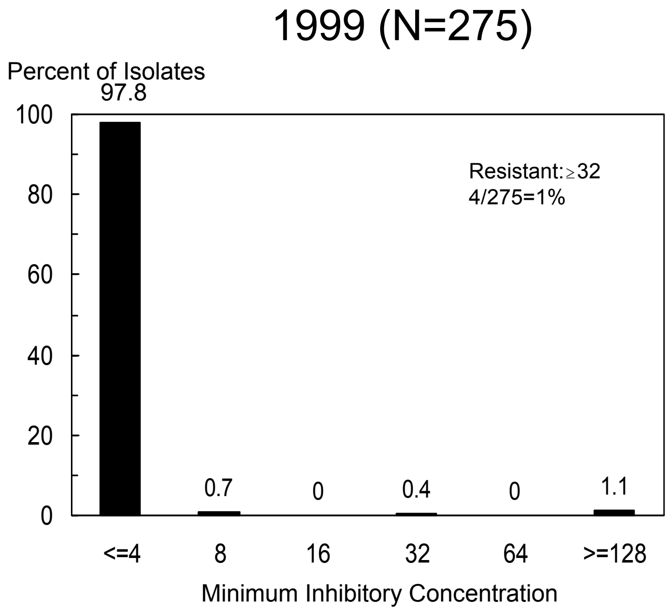


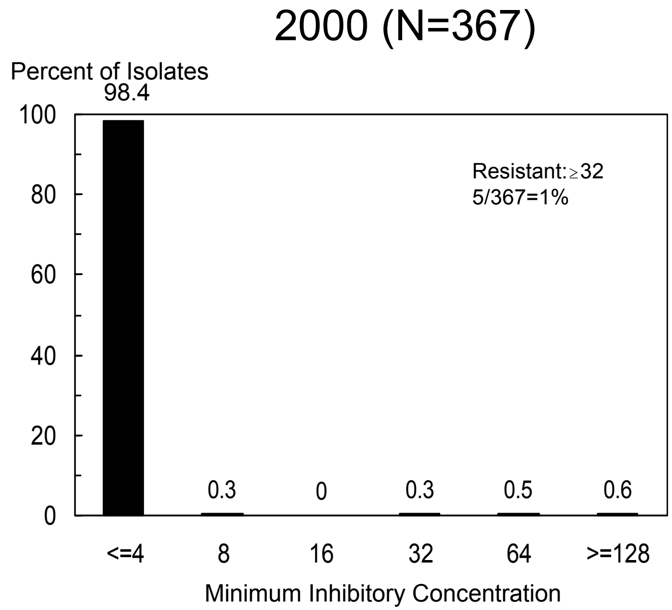




National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 15m. MICs for nalidixic acid among *Shigella sonnei* isolates, 1999-2001





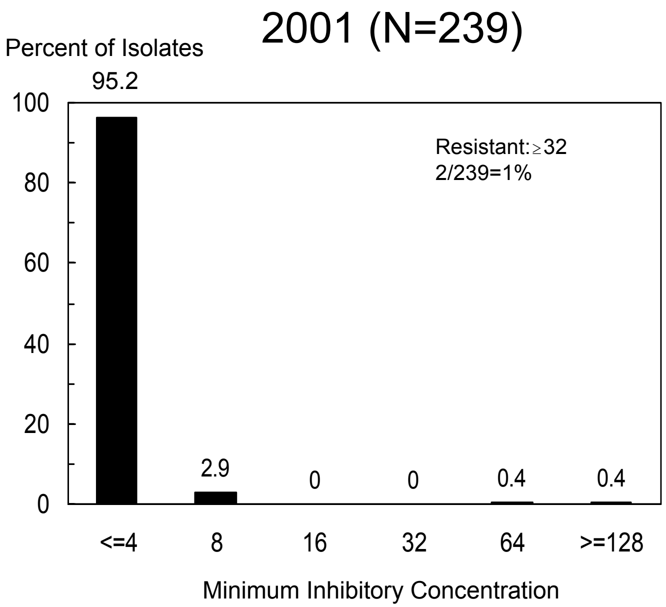


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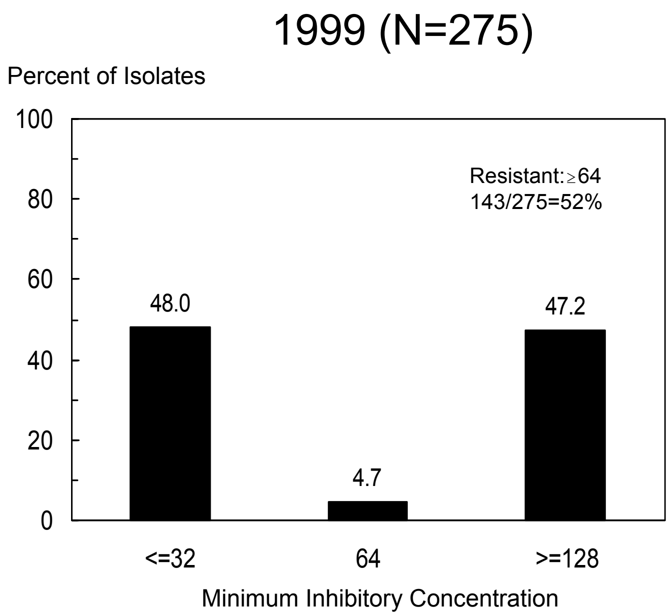
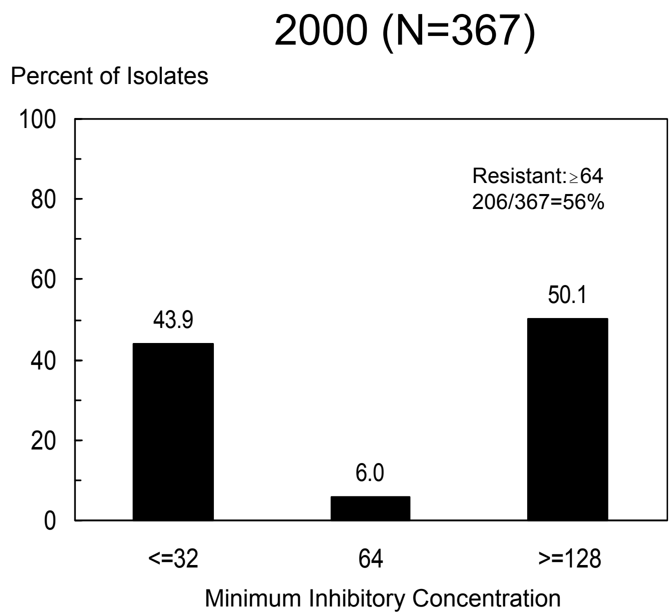
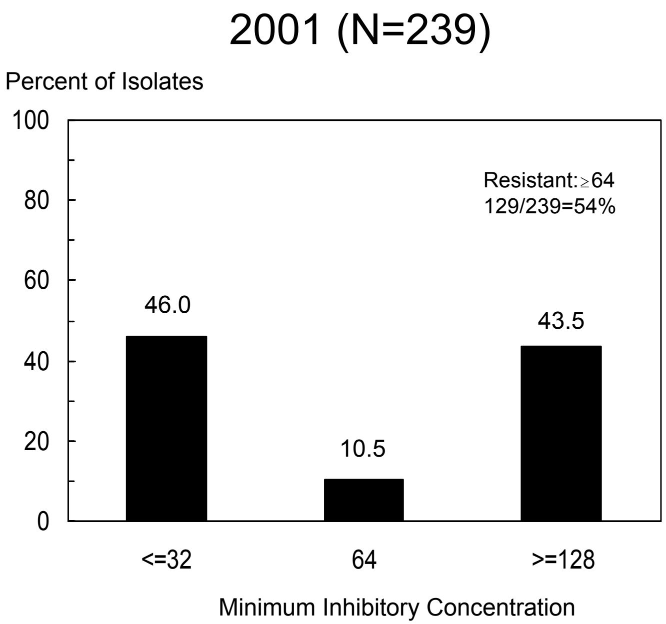
Figure 15n. MICs for streptomycin among *Shigella sonnei* isolates, 1999-2001

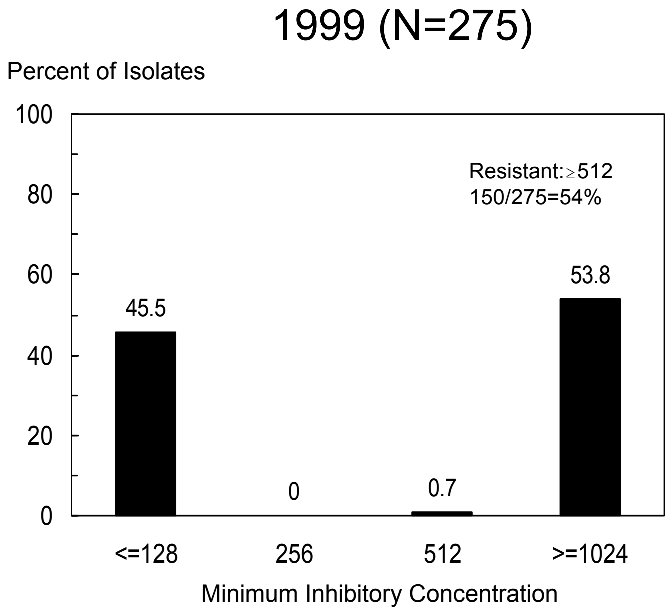


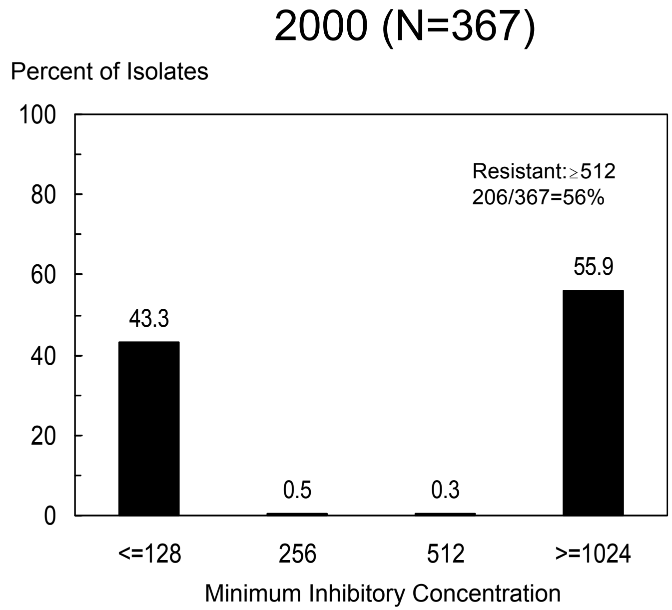


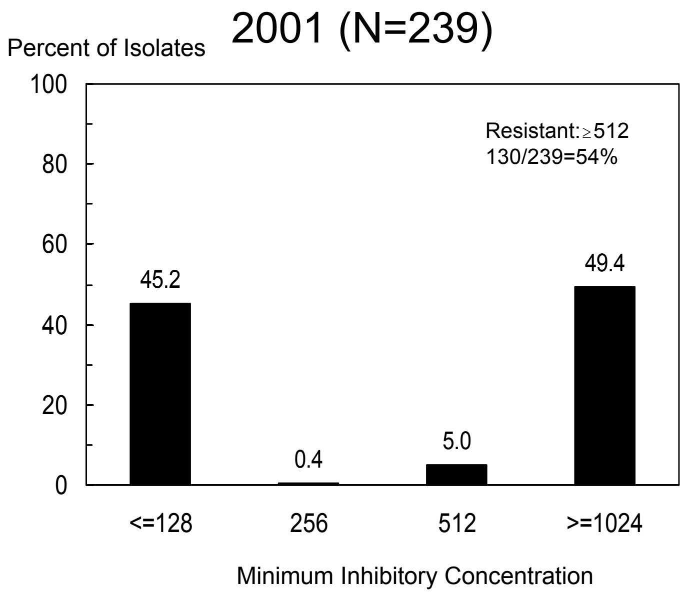


National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 15o. MICs for sulfamethoxazole among *Shigella sonnei* isolates, 1999-2001

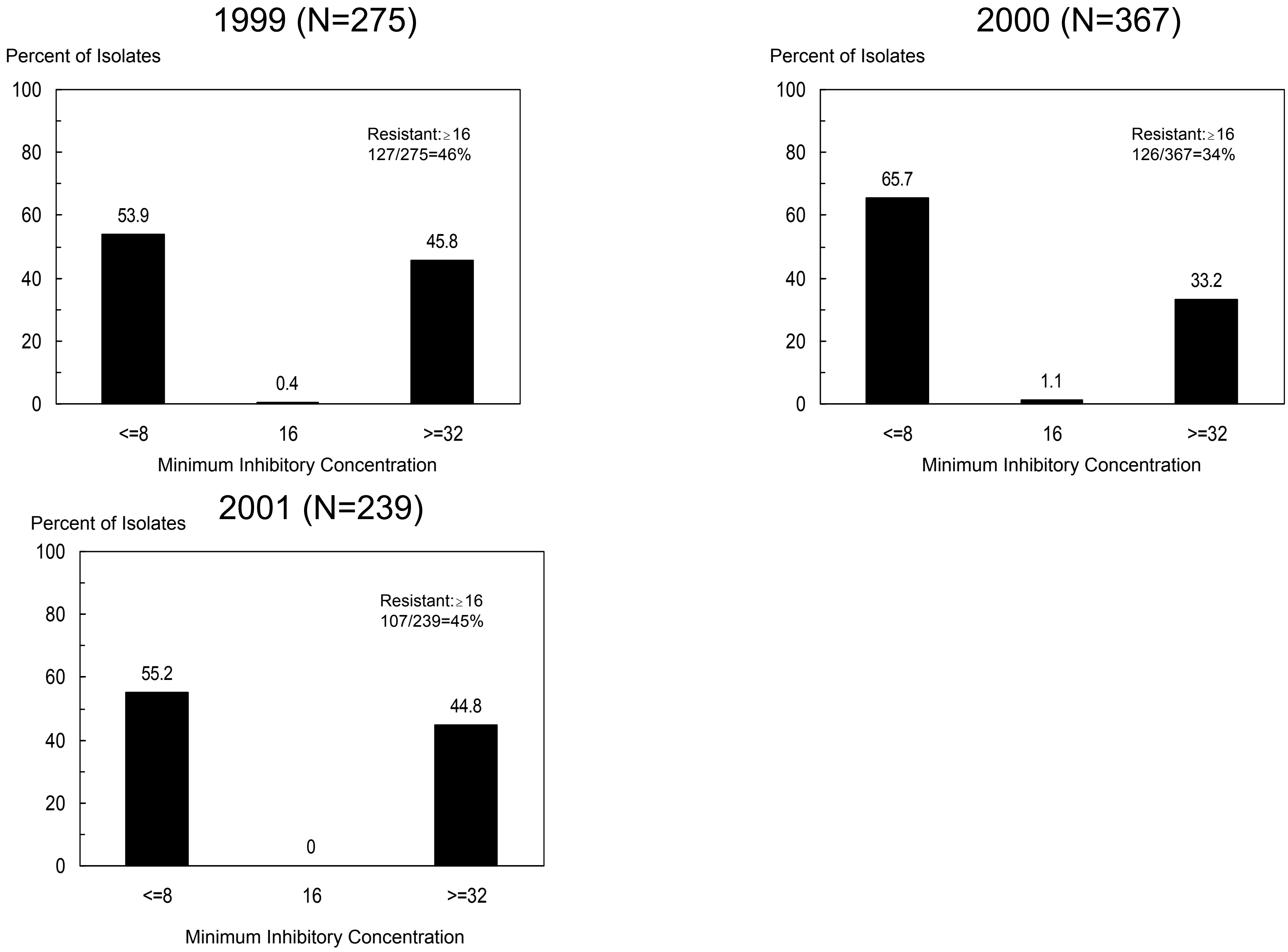






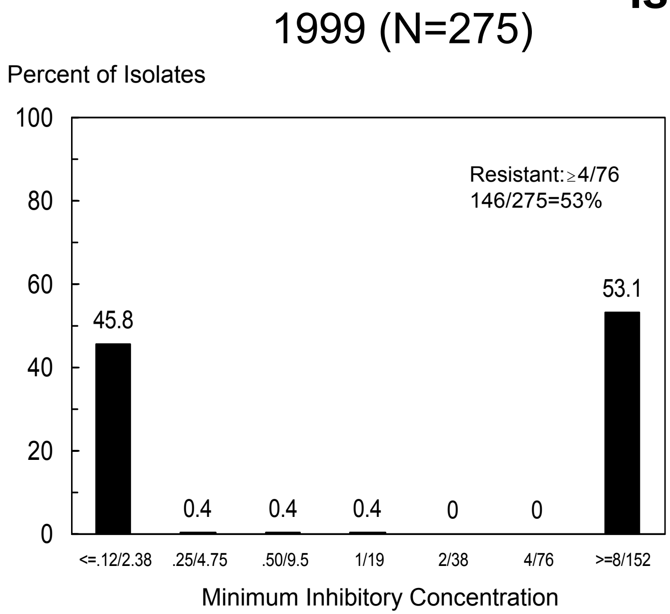
National Antimicrobial Resistance Monitoring System For Enteric Bacteria

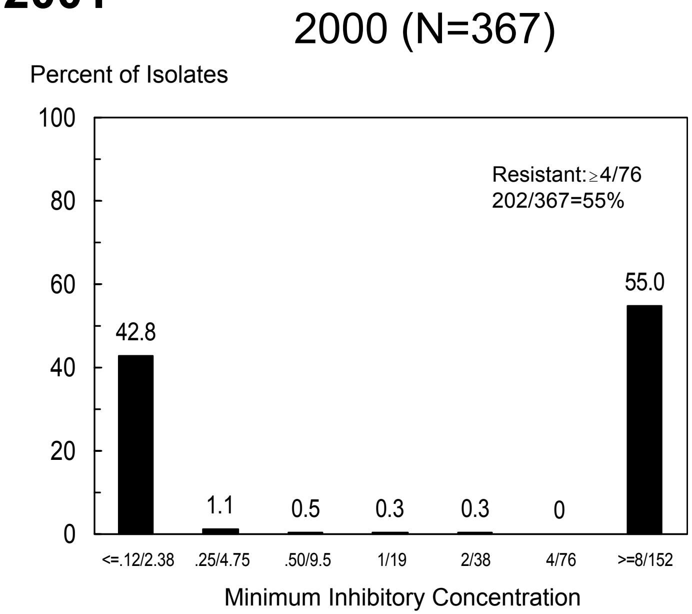
Figure 15p. MICs for tetracycline among *Shigella sonnei* isolates, 1999-2001



National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 15q. MICs for trimethoprim-sulfamethoxazole among *Shigella sonnei* isolates, 1999-2001





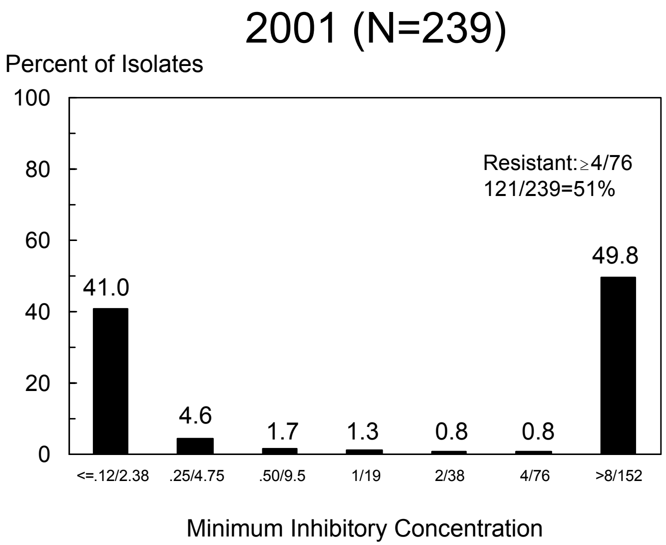


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Figure 16a. MICs for amikacin among *Shigella flexneri* isolates, 1999-2001

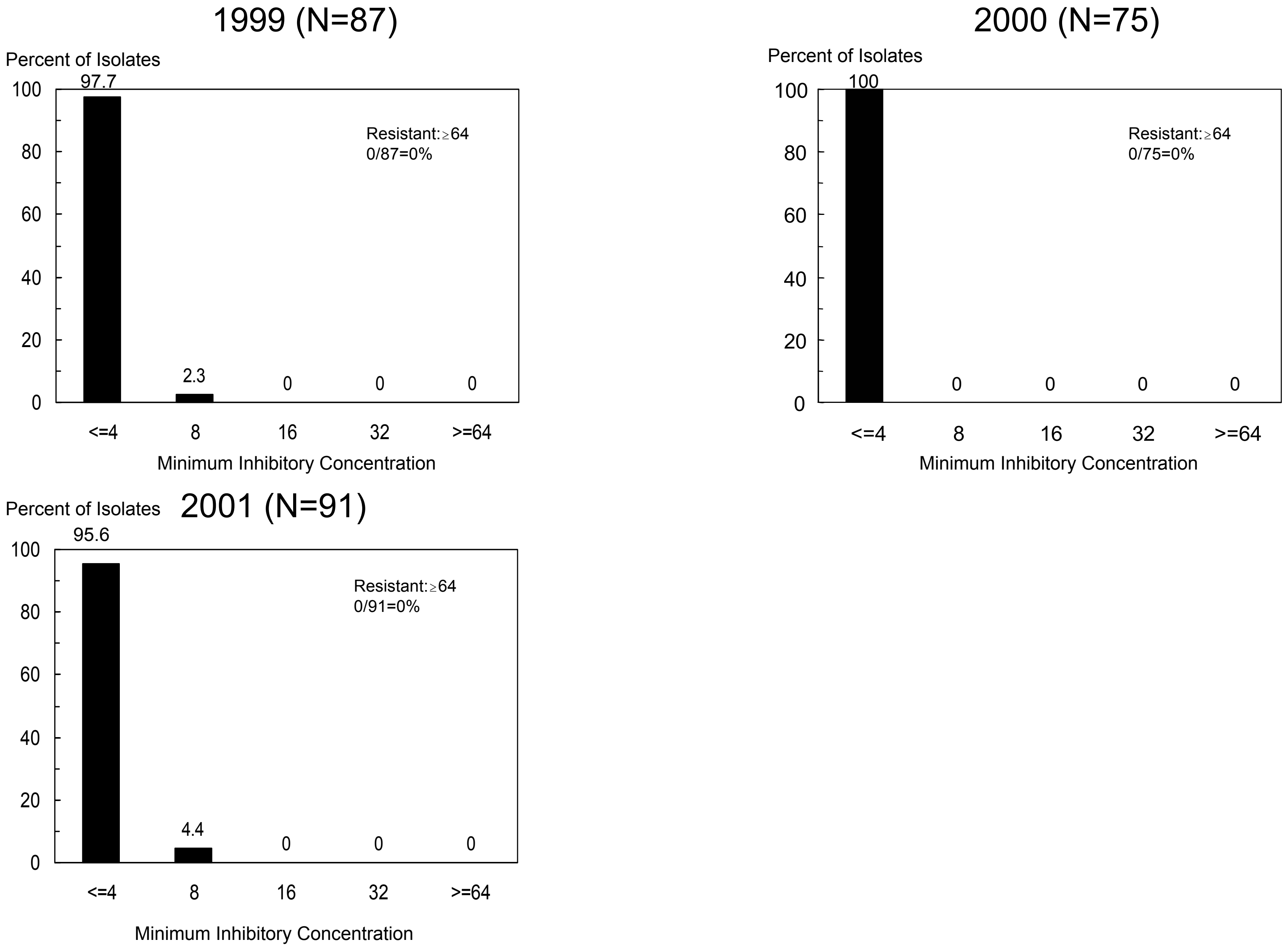

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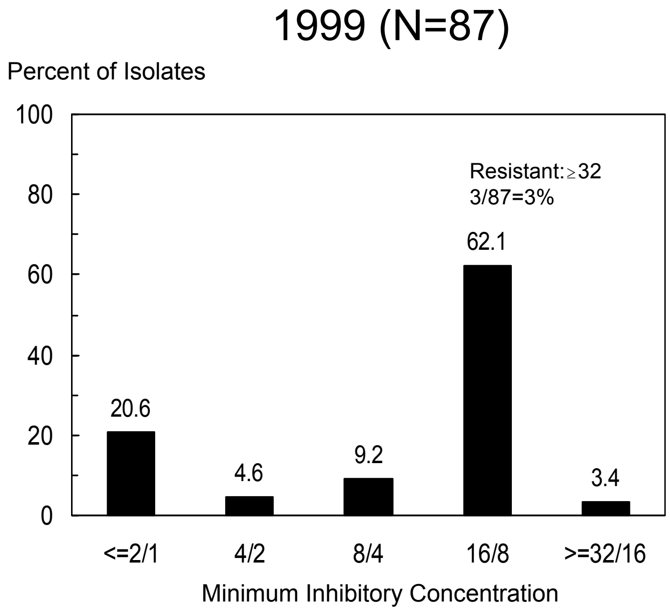
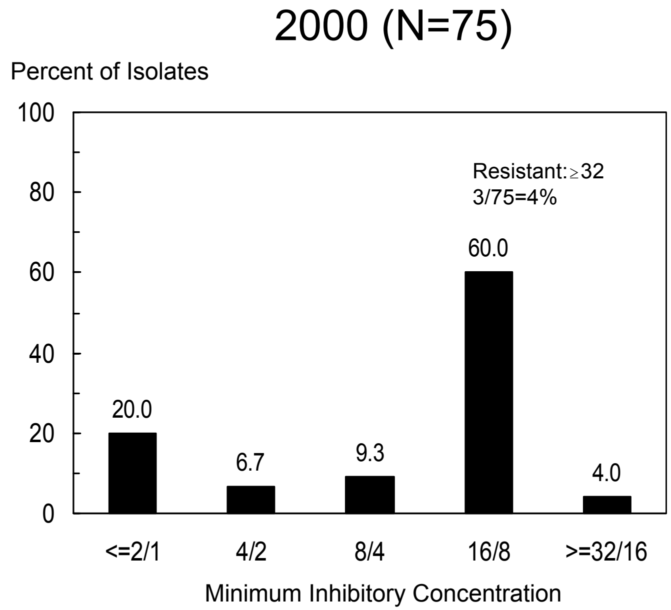
Figure 16b. MICs for amoxicillin-clavulanic acid among *Shigella flexneri* isolates, 1999-2001





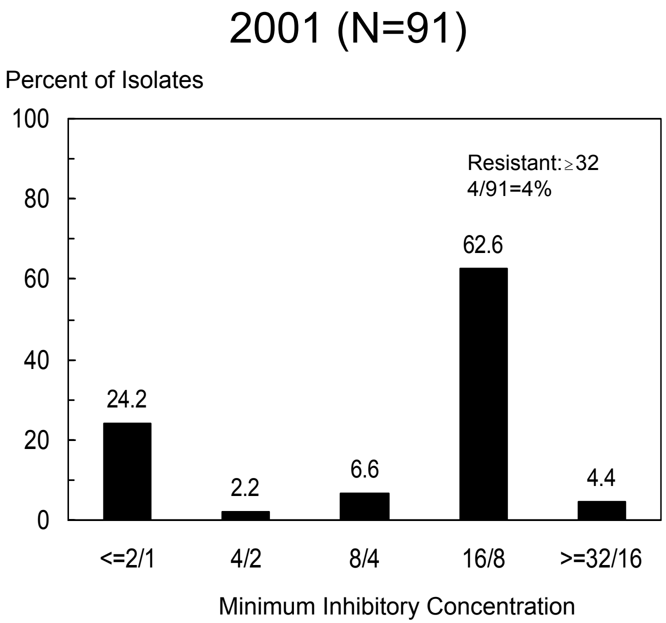


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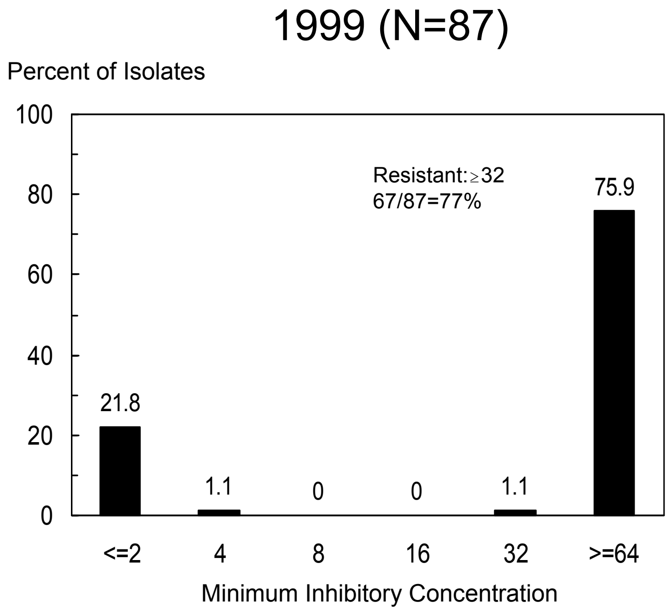
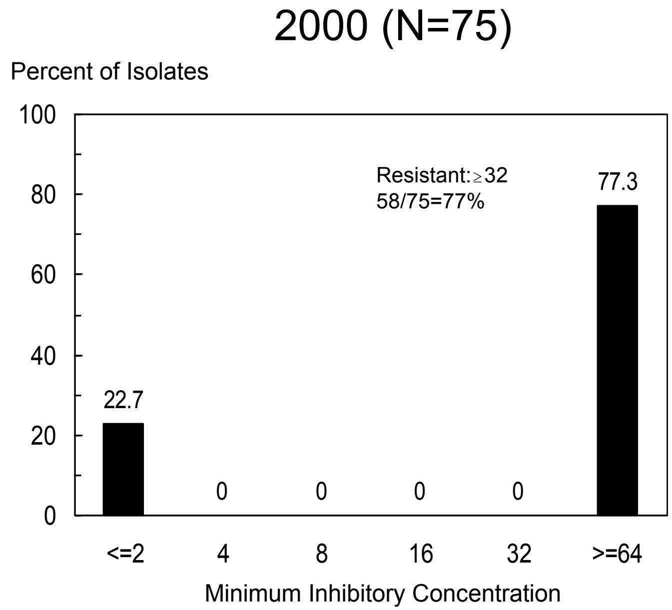
Figure 16c. MICs for ampicillin among *Shigella flexneri* isolates, 1999-2001





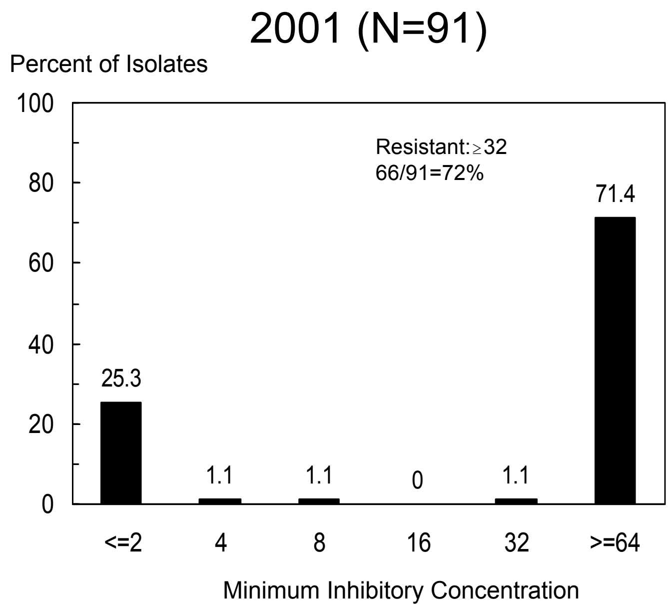


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Figure 16d. MICs for apramycin among *Shigella flexneri* isolates, 1999-2001

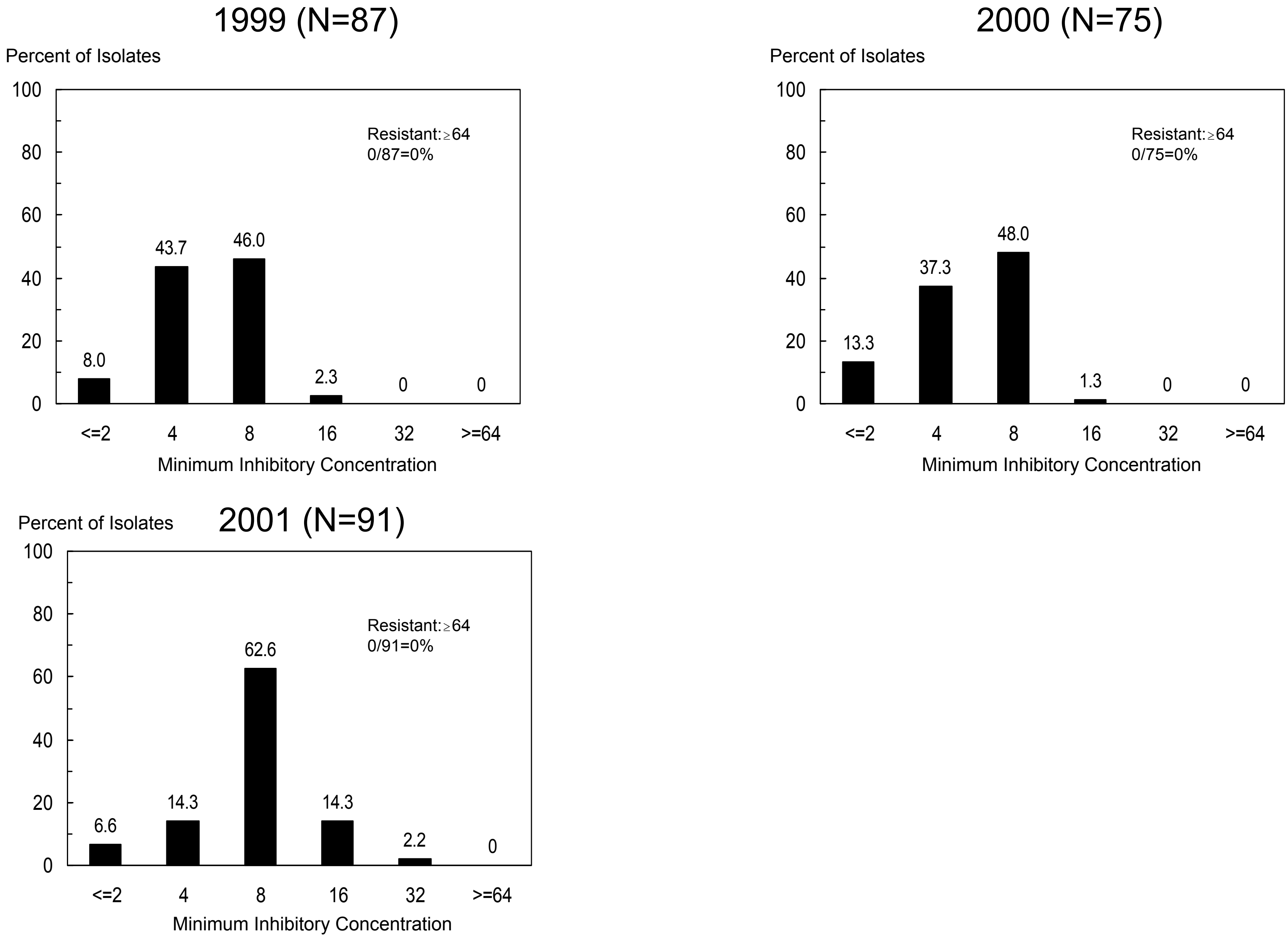

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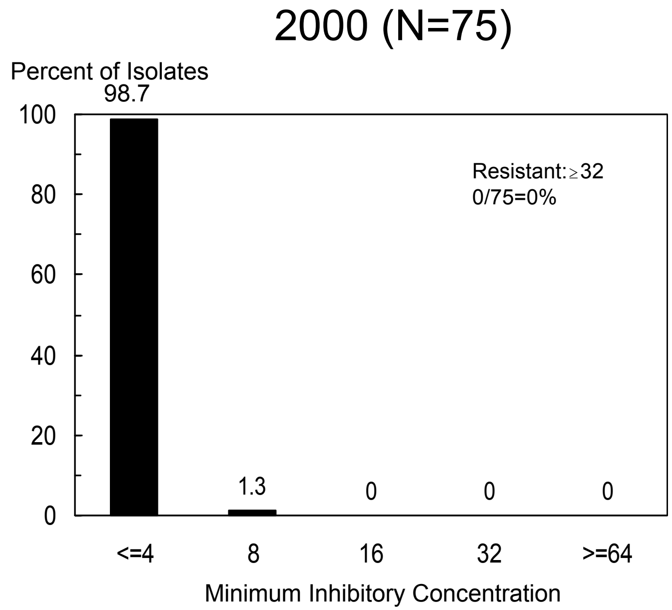
Figure 16e. MICs for cefoxitin among *Shigella flexneri* isolates, 1999-2001

Not Tested in 1999



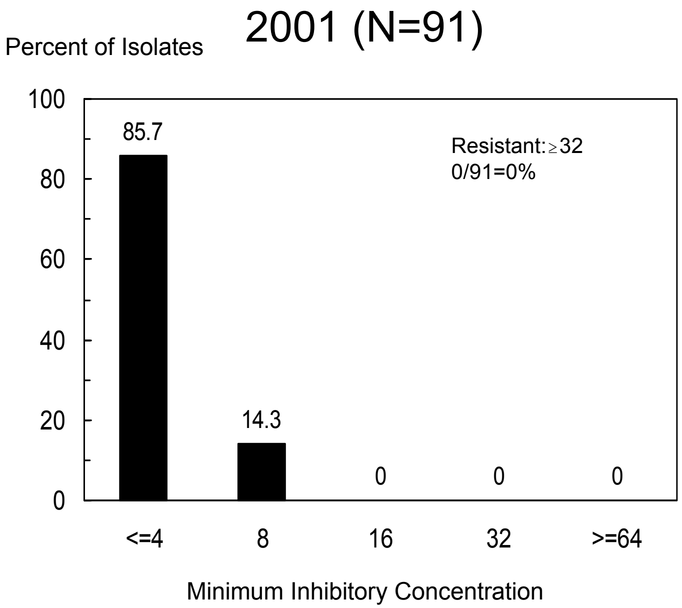


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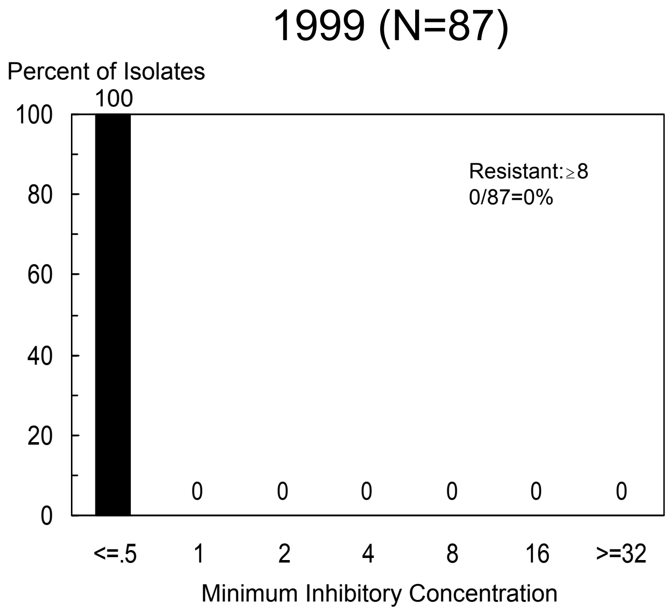
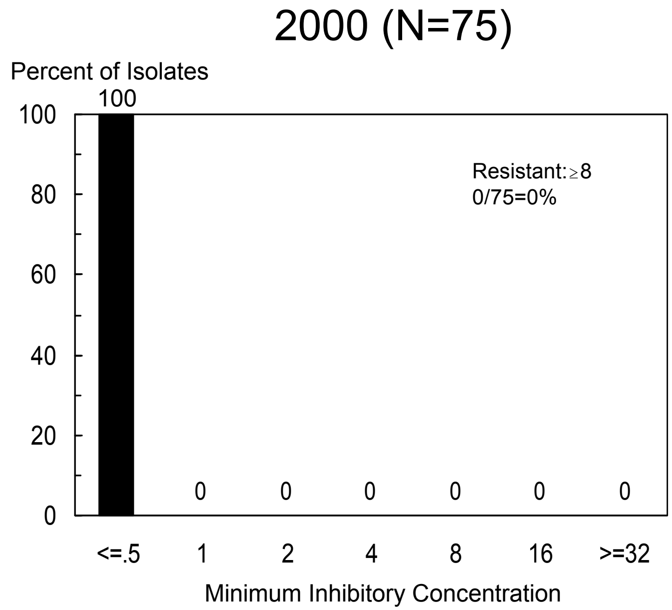
Figure 16f. MICs for ceftiofur among *Shigella flexneri* isolates, 1999-2001





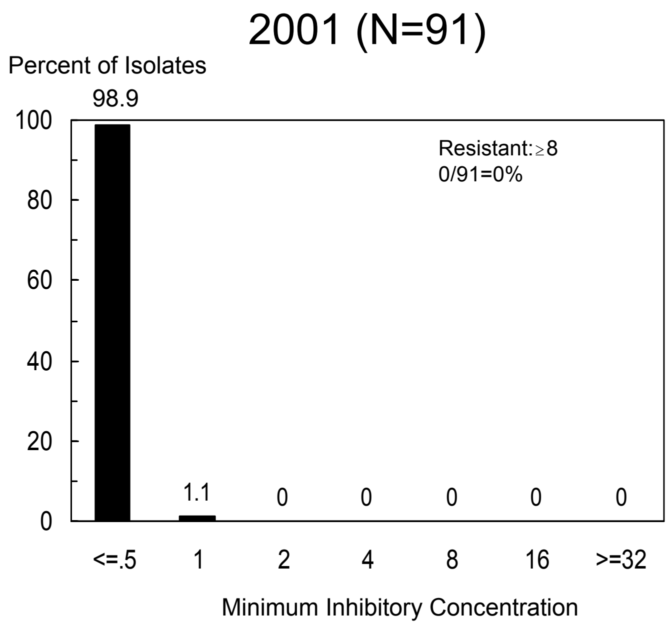


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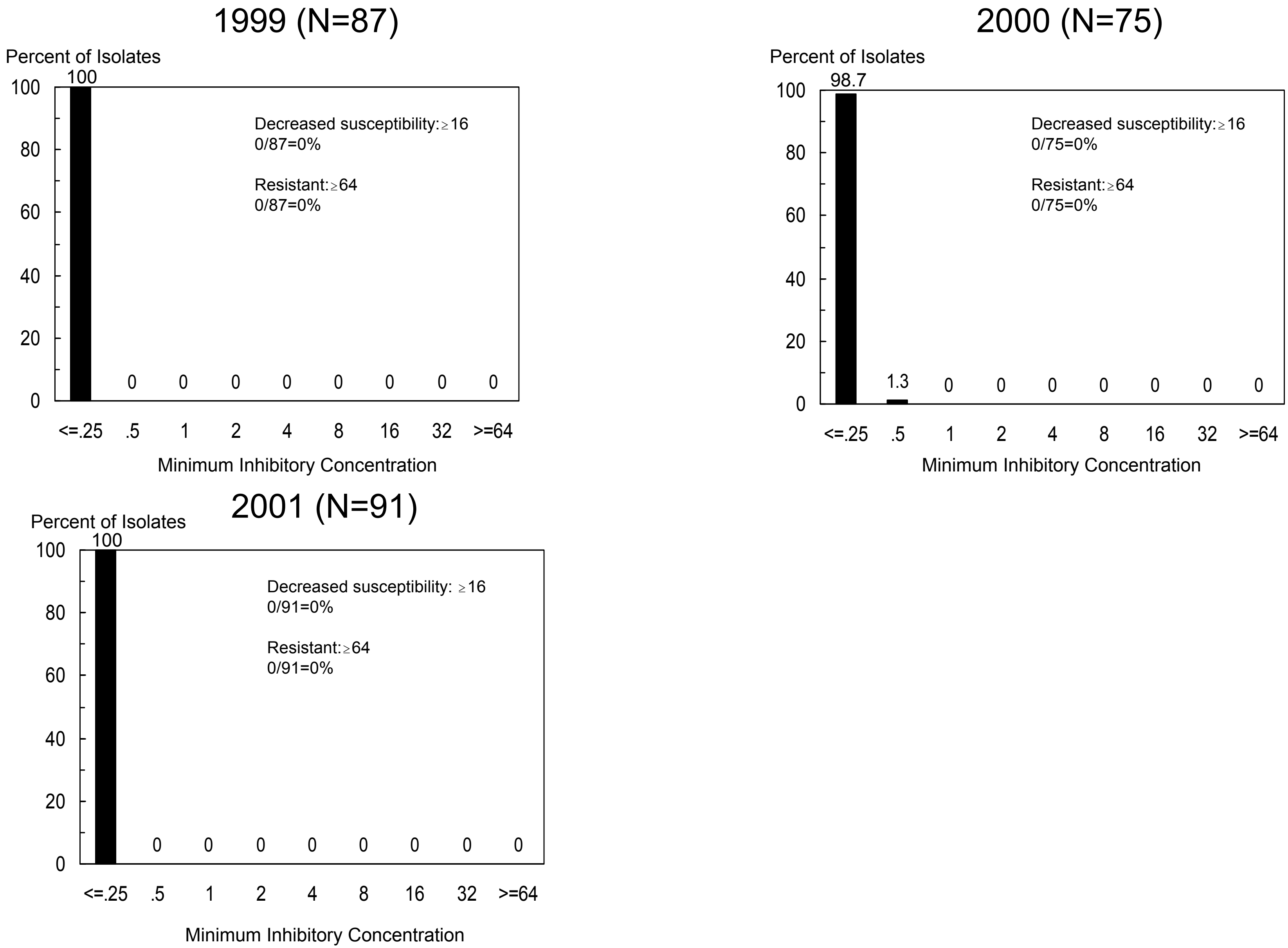
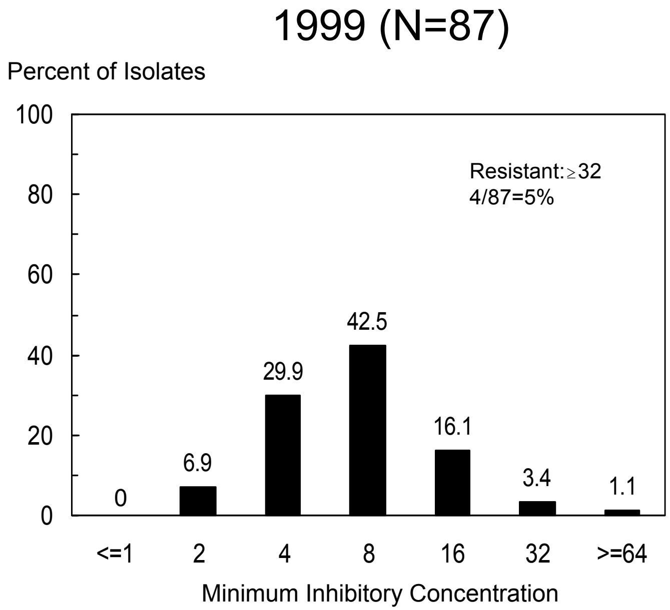
Figure 16g. MICs for ceftriaxone* among *Shigella flexneri* isolates, 1999-2001

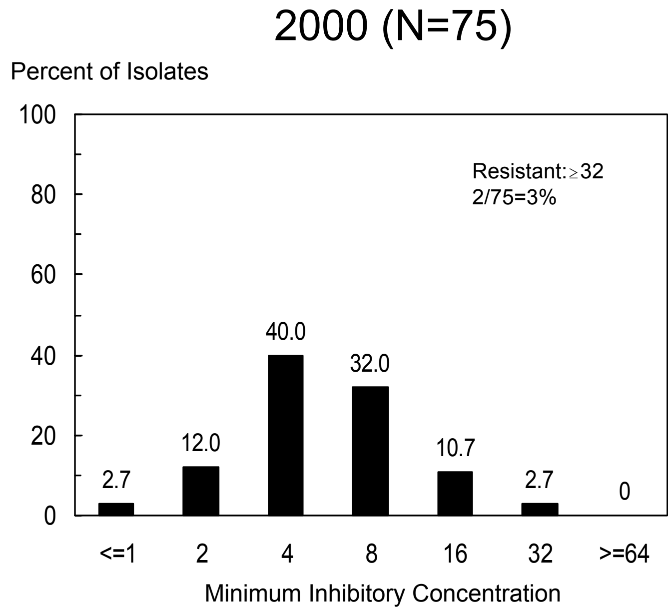


*Sensititre® results only

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 16h. MICs for cephalothin among *Shigella flexneri* isolates, 1999-2001





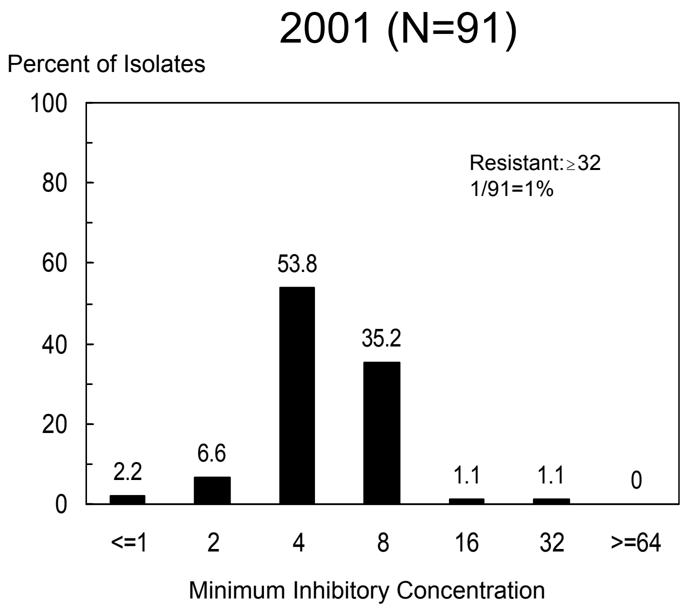


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Figure 16i. MICs for chloramphenicol among *Shigella flexneri* isolates, 1999-2001

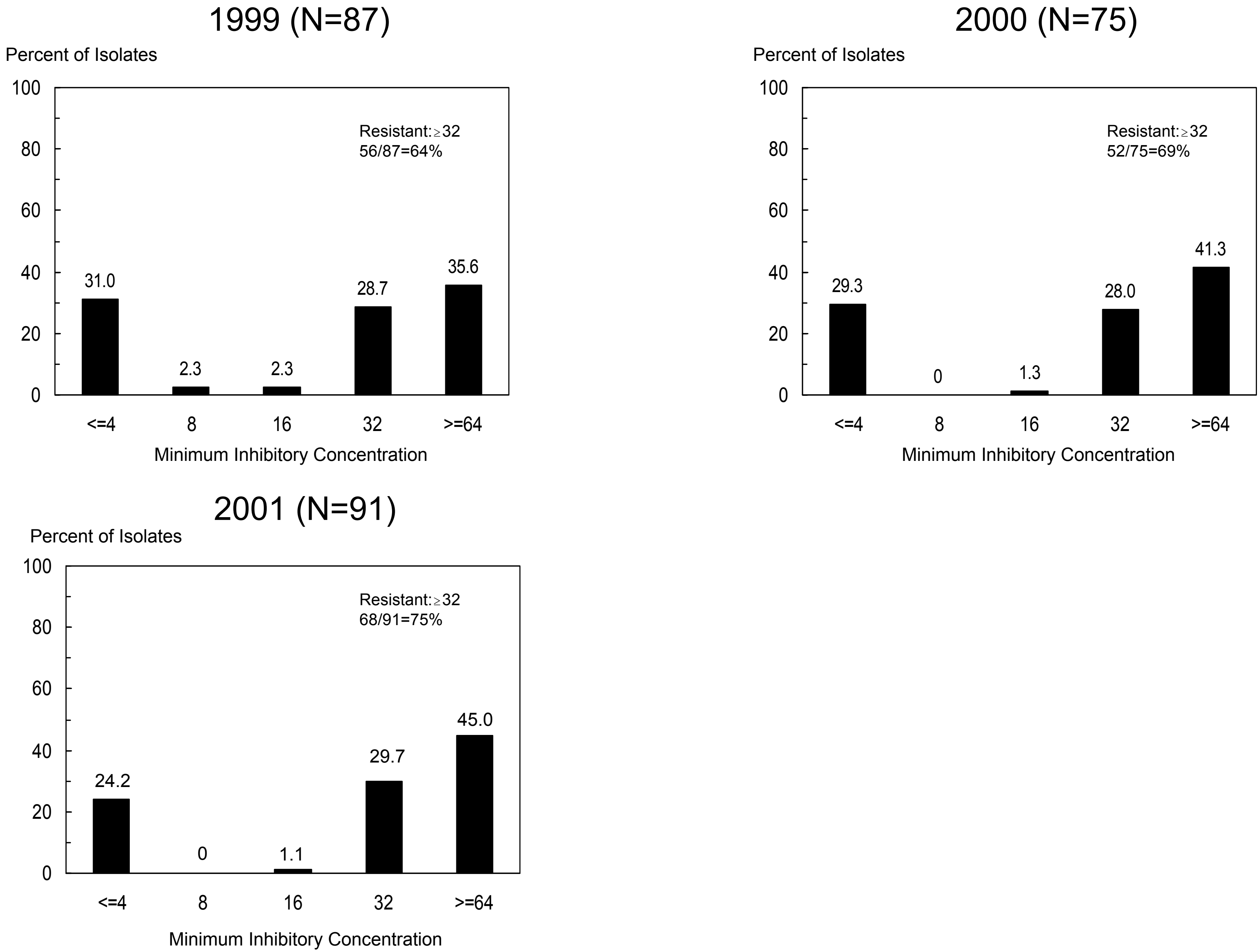

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Figure 16j. MICs for ciprofloxacin among *Shigella flexneri* isolates, 1999-2001

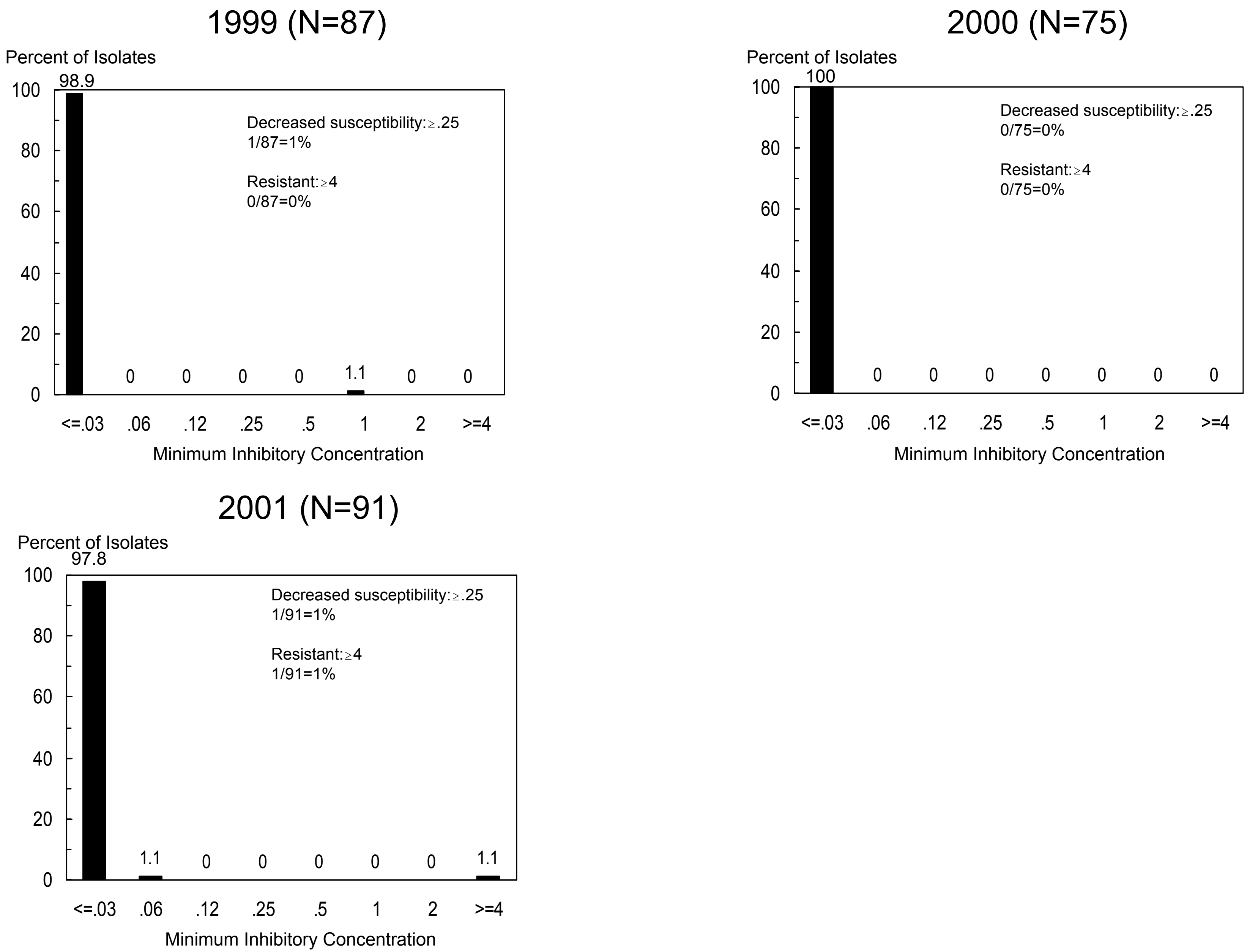

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Figure 16k. MICs for gentamicin among *Shigella flexneri* isolates, 1999-2001

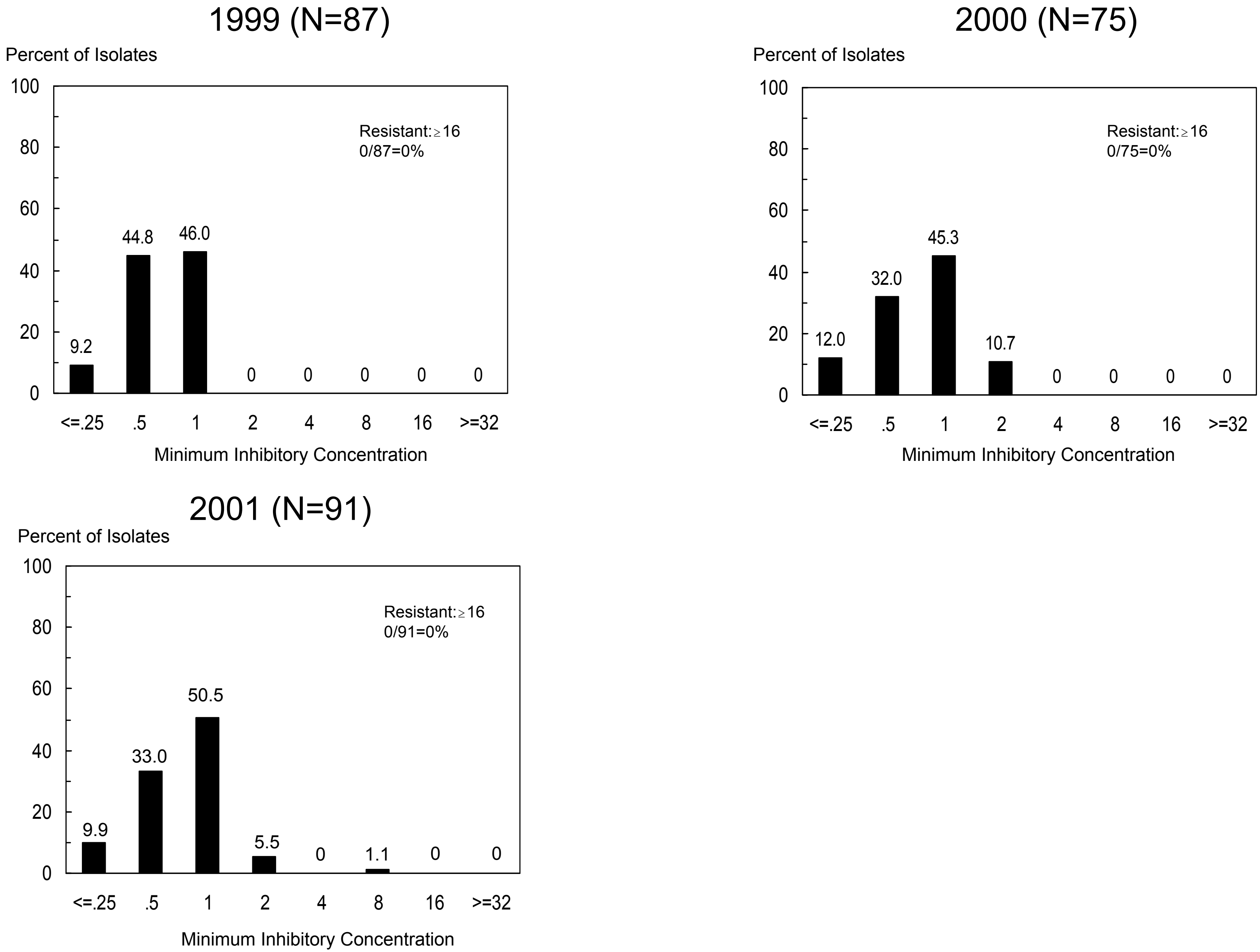

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Figure 16I. MICs for kanamycin among *Shigella flexneri* isolates, 1999-2001

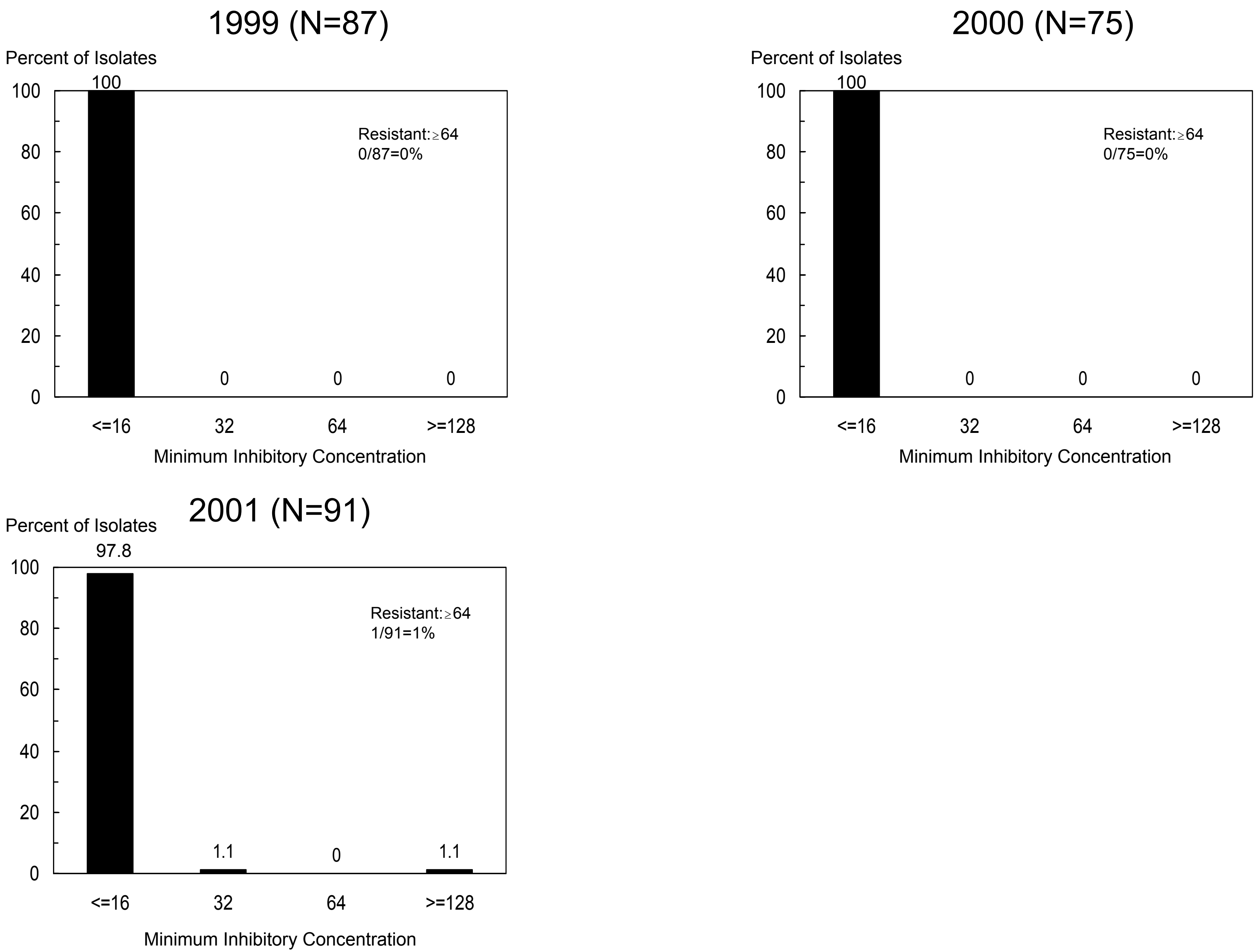

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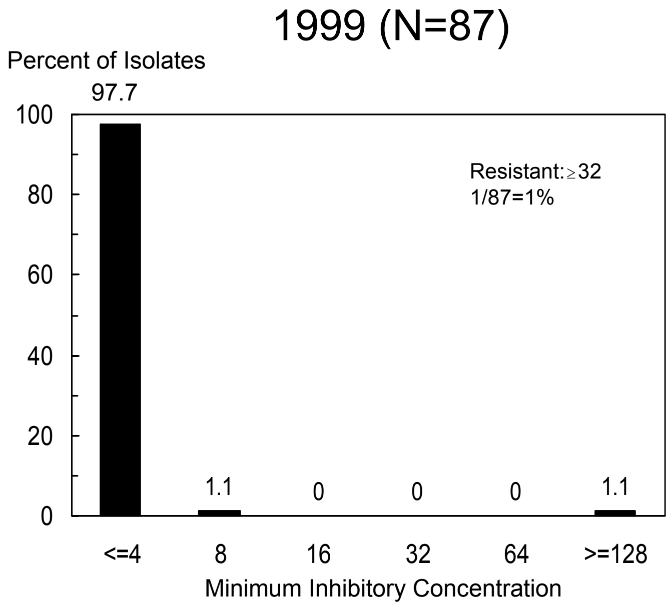
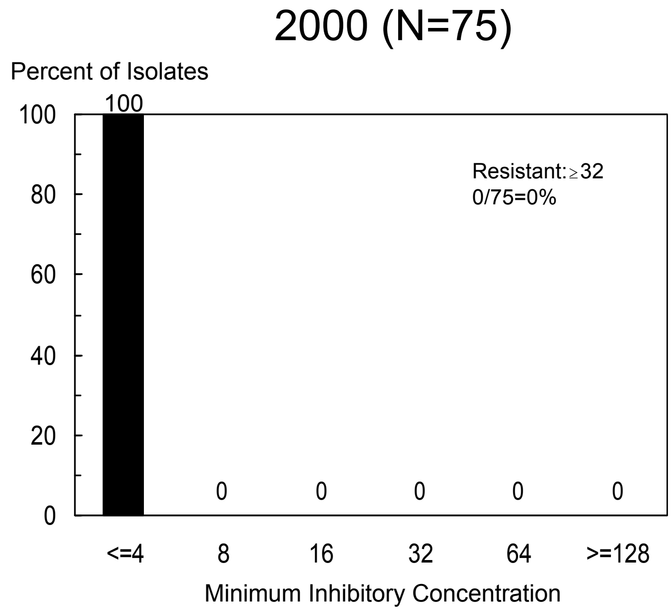
Figure 16m. MICs for nalidixic acid among *Shigella flexneri* isolates, 1999-2001





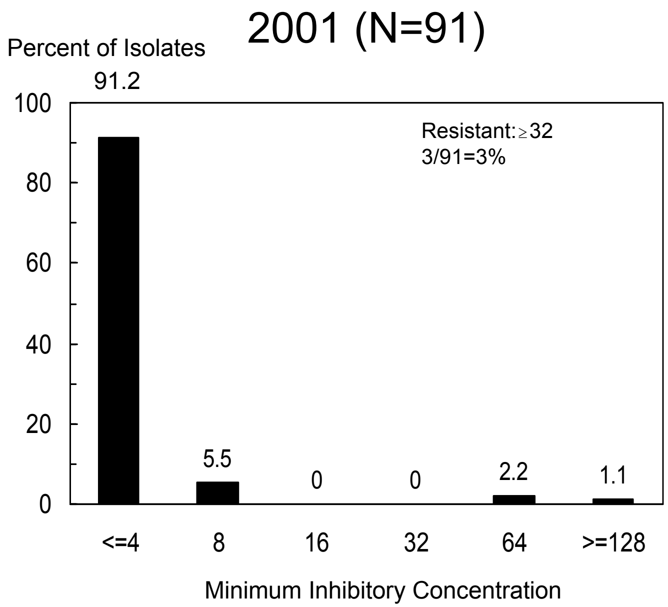


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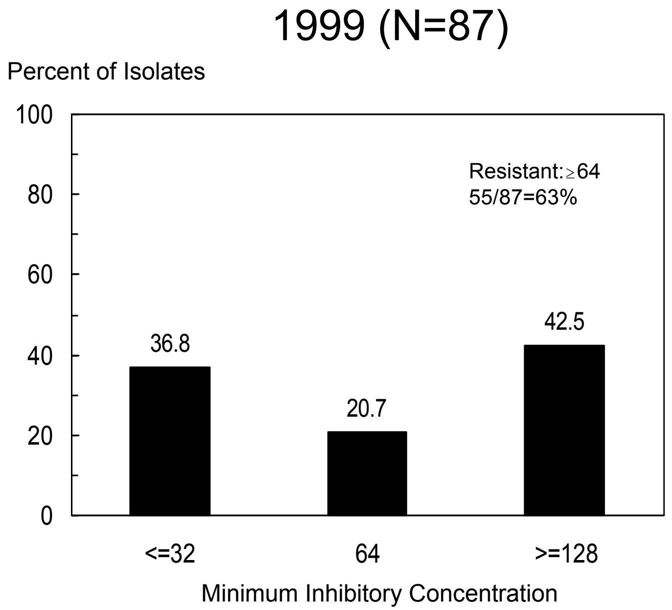
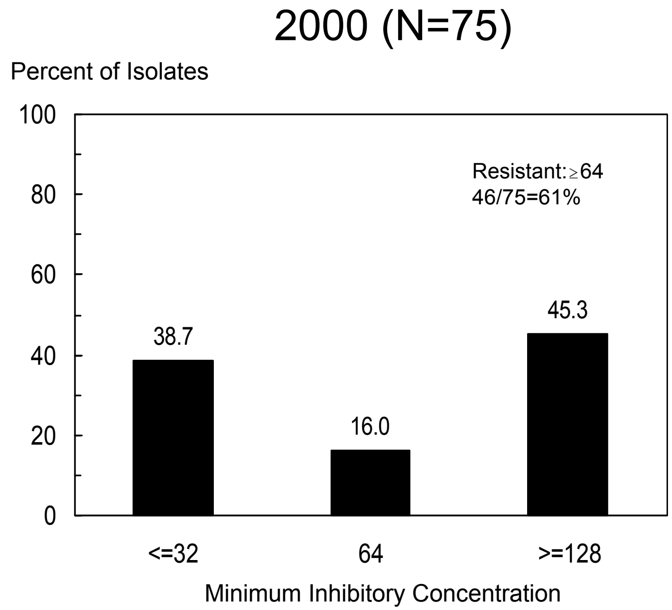
Figure 16n. MICs for streptomycin among *Shigella flexneri* isolates, 1999-2001





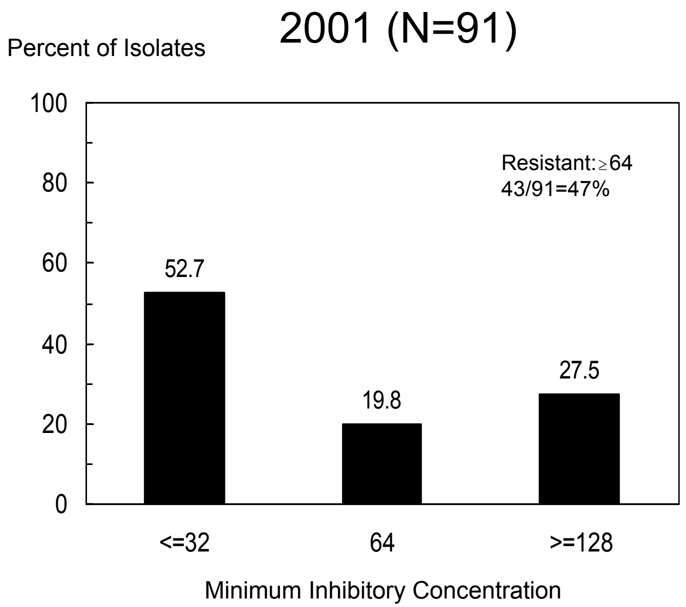


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Figure 16o. MICs for sulfamethoxazole among *Shigella flexneri* isolates, 1999-2001

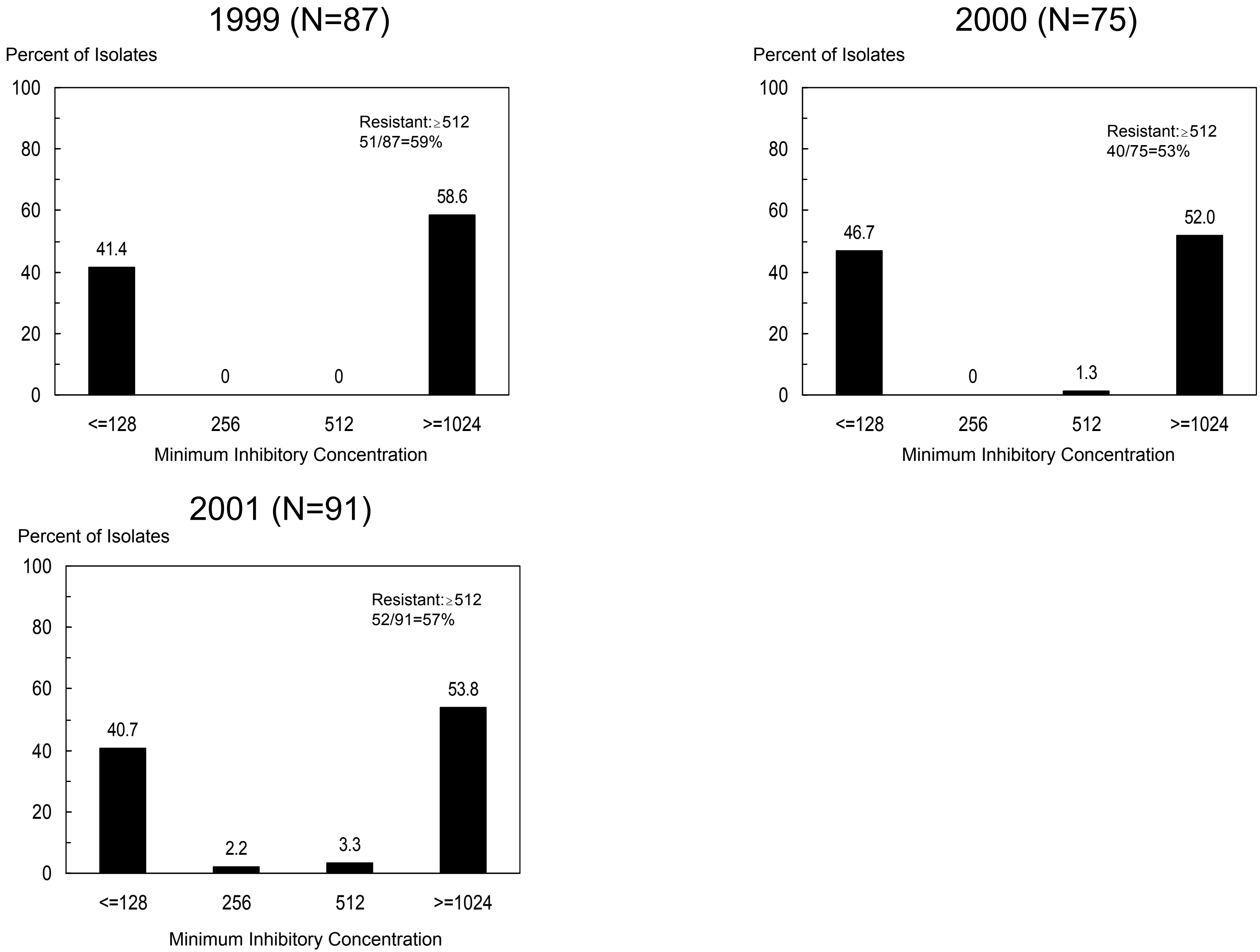

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Figure 16p. MICs for tetracycline among *Shigella flexneri* isolates, 1999-2001

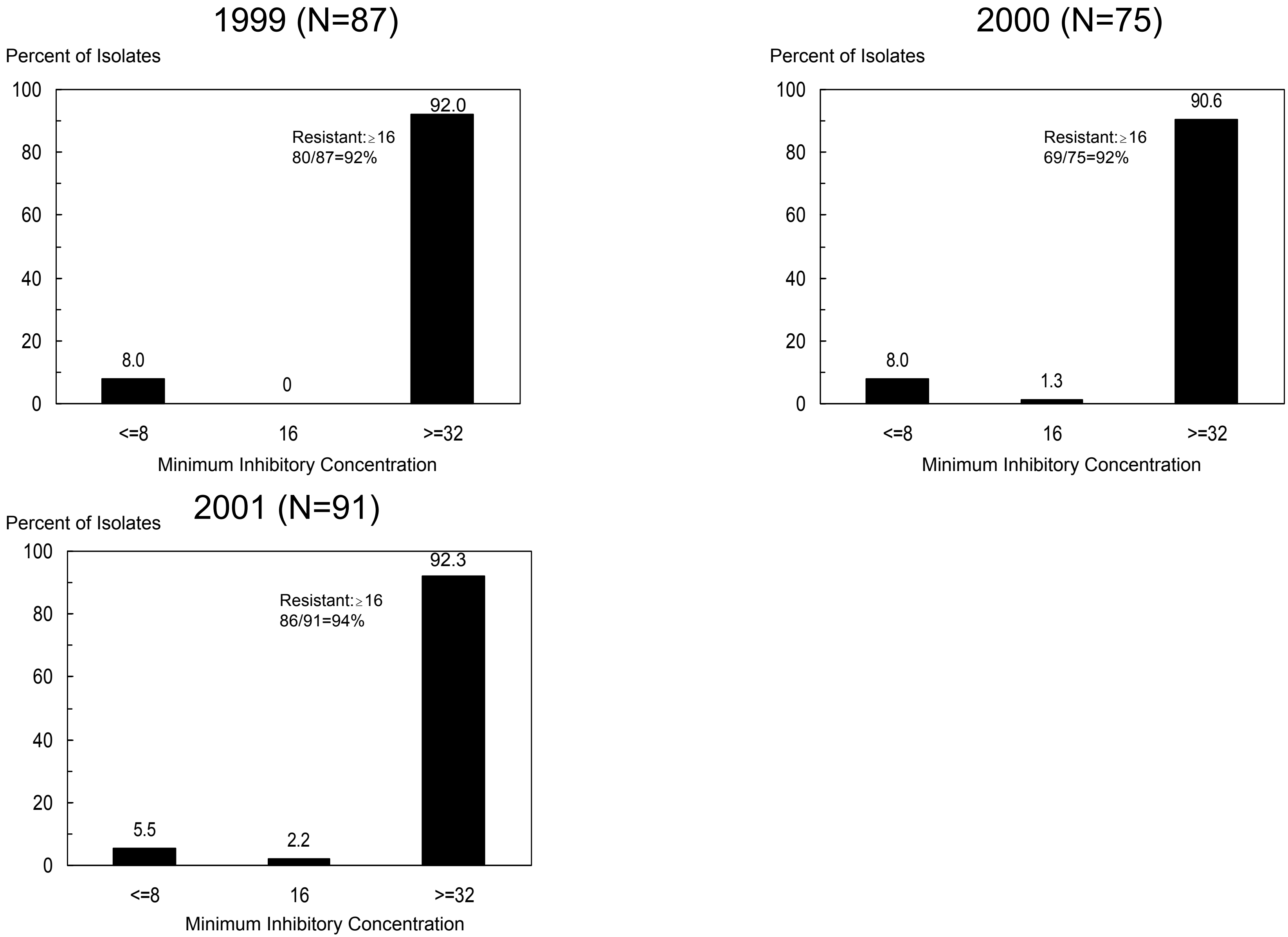

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Figure 16q. MICs for trimethoprim-sulfamethoxazole among *Shigella flexneri* isolates, 1999-2001

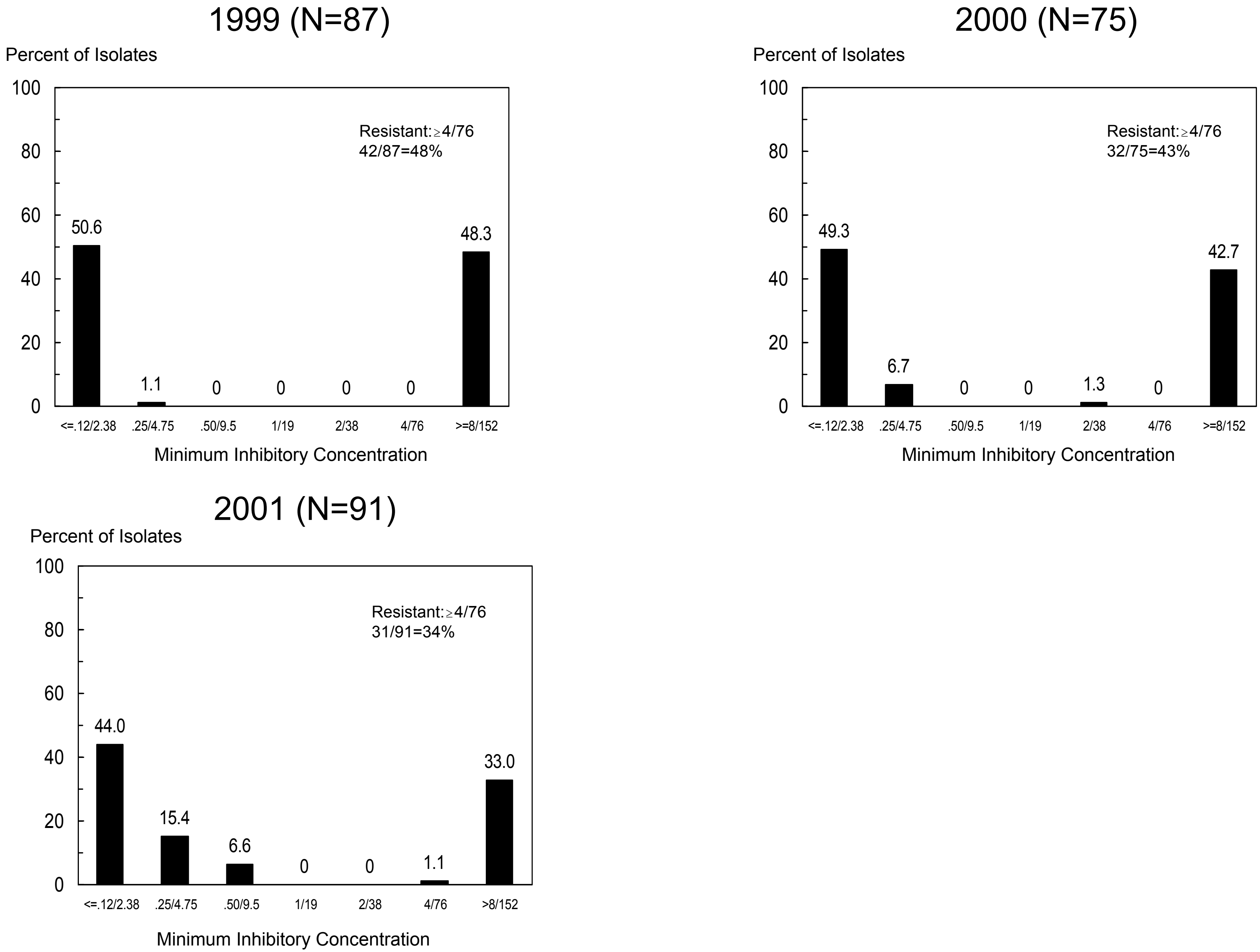

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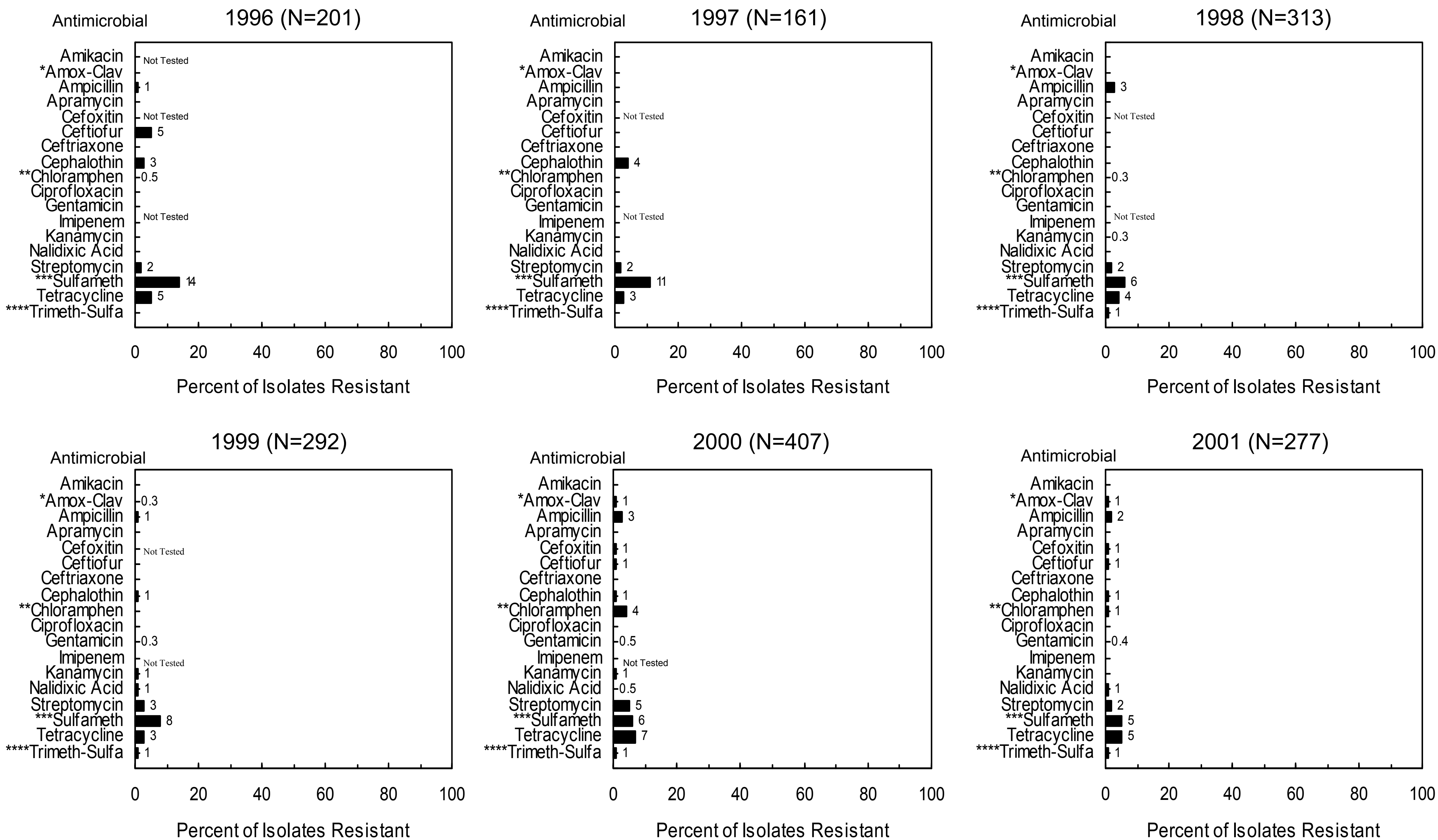
Figure 17. Resistance among *E. coli* O157 isolates, 1996-2001



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

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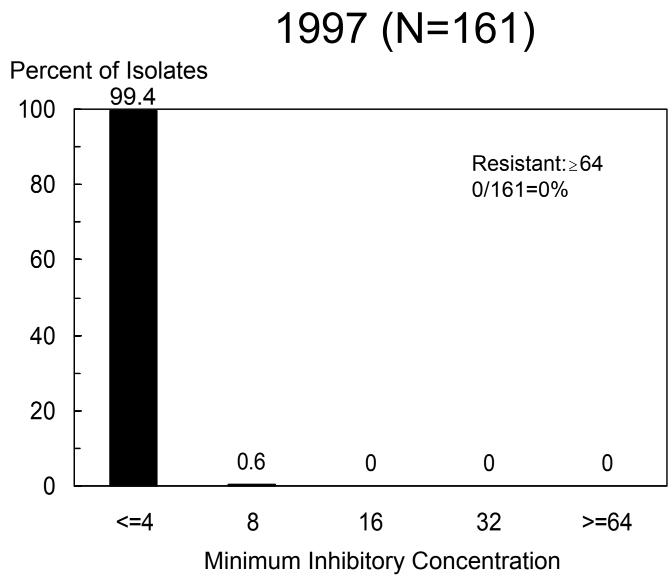
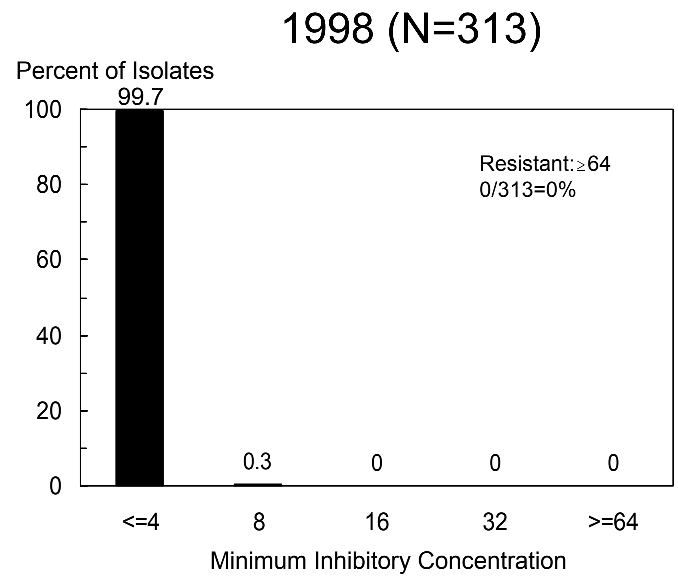
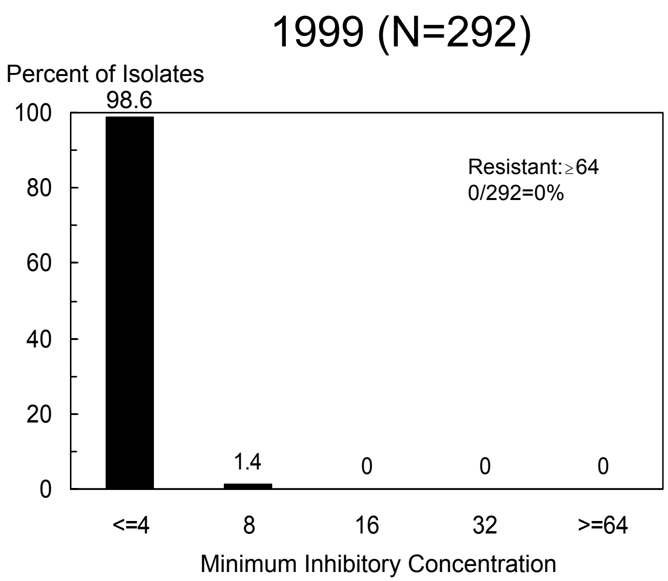
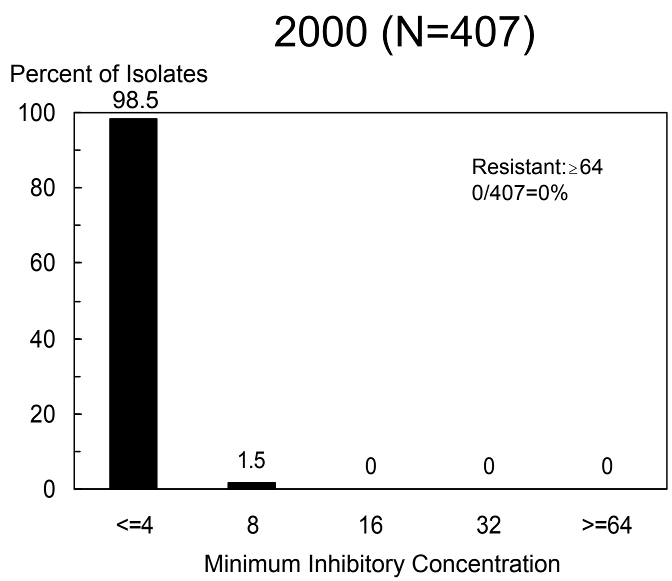
Figure 18a. MICs for amikacin among *E. coli* O157 isolates, 1996-2001

Not Tested in 1996









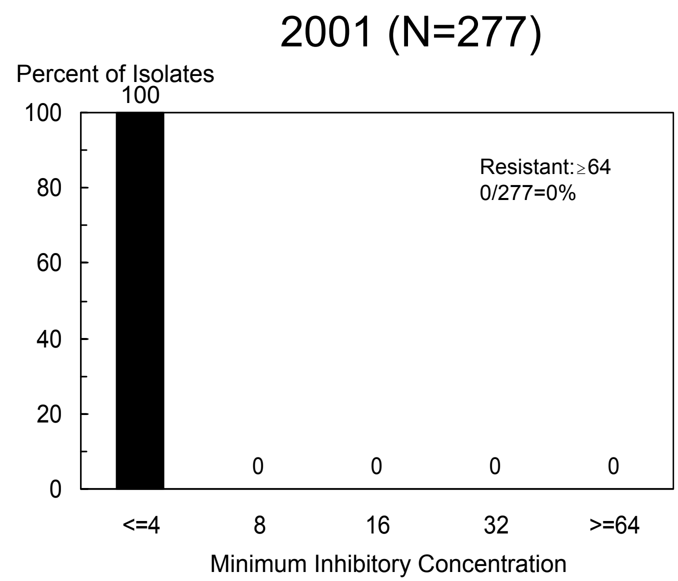


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Figure 18b. MICs for amoxicillin-clavulanic acid among *E. coli* O157 isolates, 1996-2001

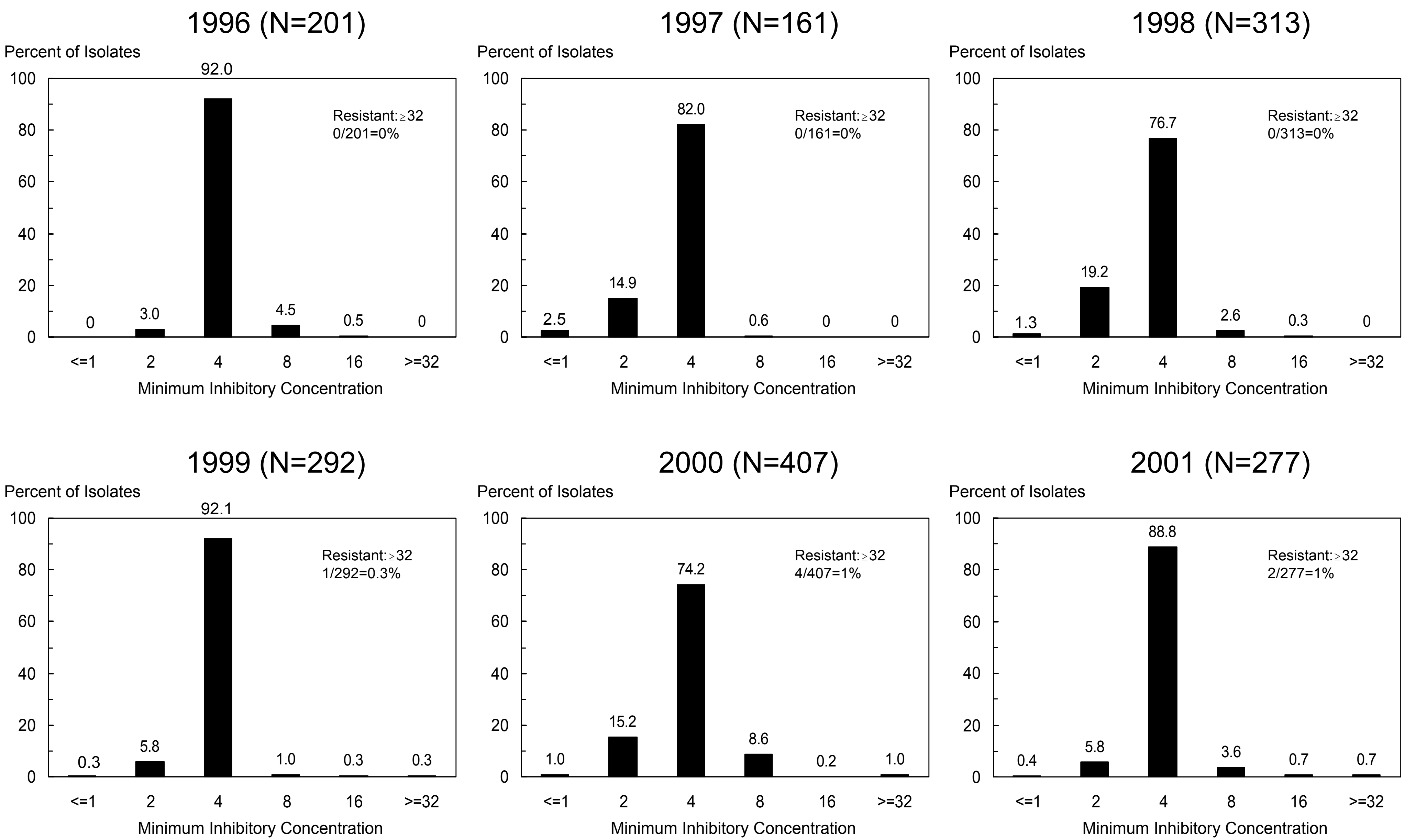

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Figure 18c. MICs for ampicillin among *E. coli* O157 isolates, 1996-2001

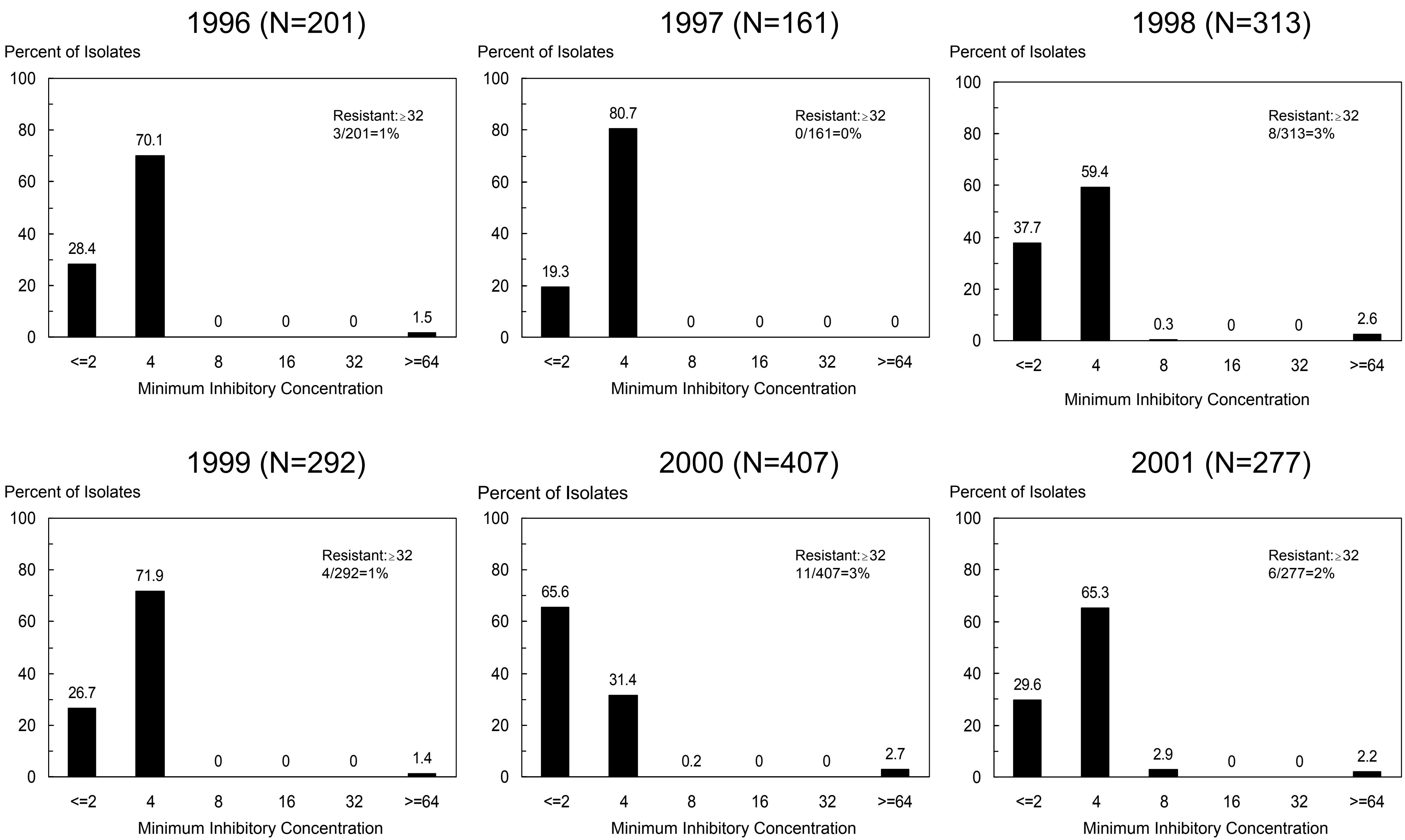

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Figure 18d. MICs for apramycin among *E. coli* O157 isolates, 1996-2001

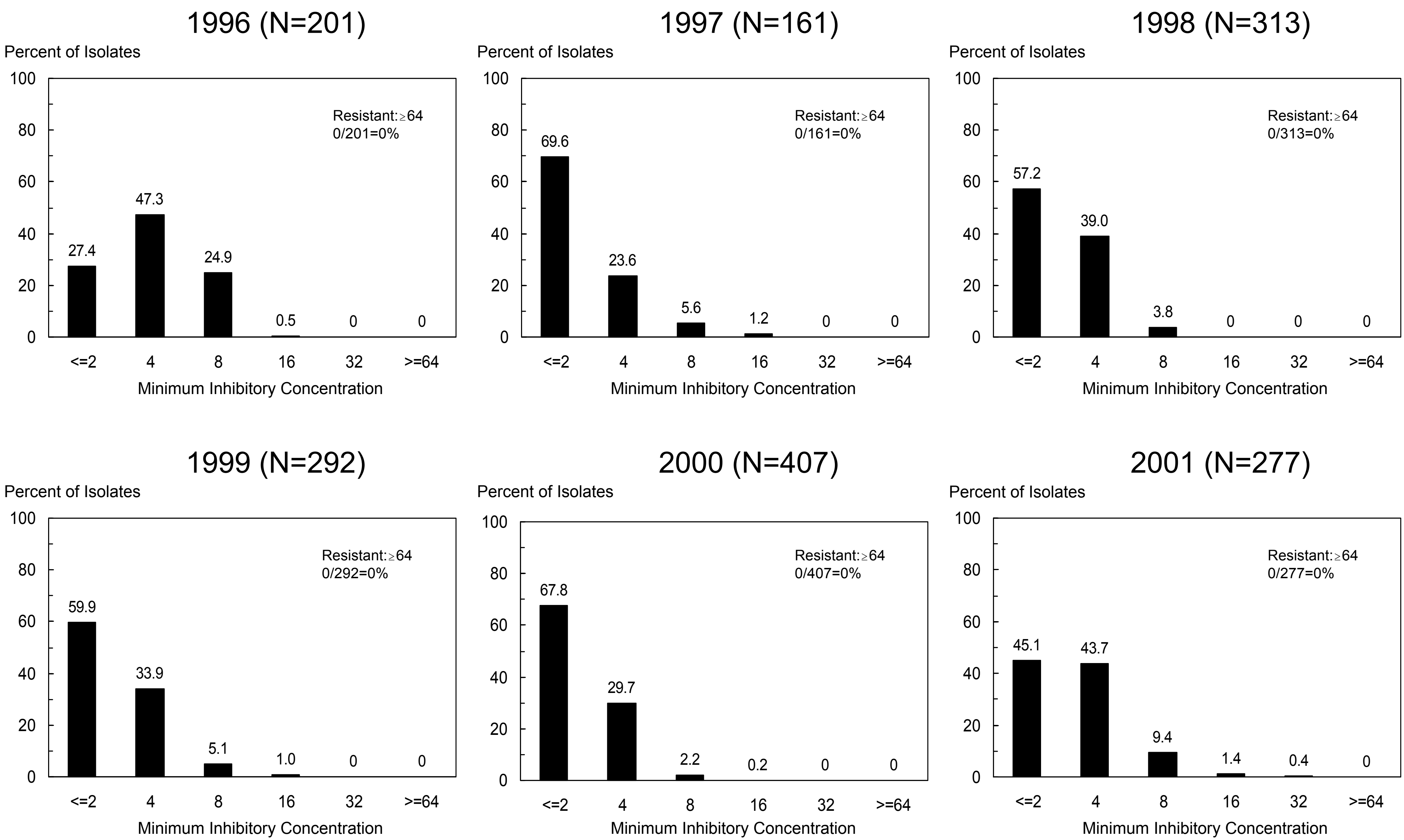

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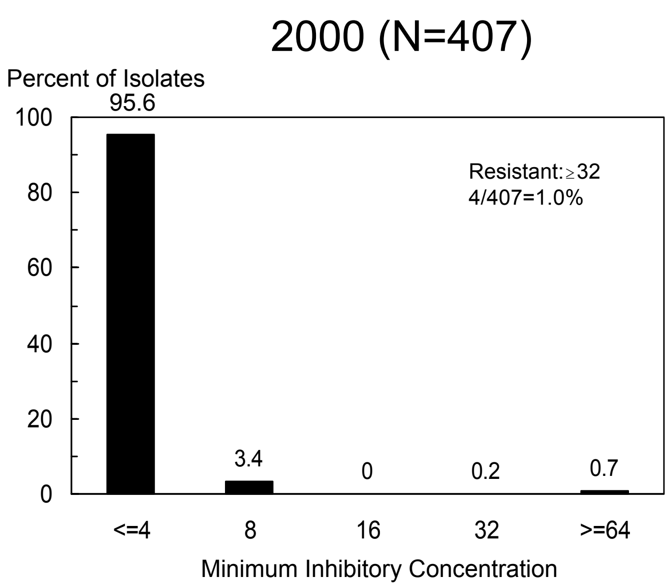
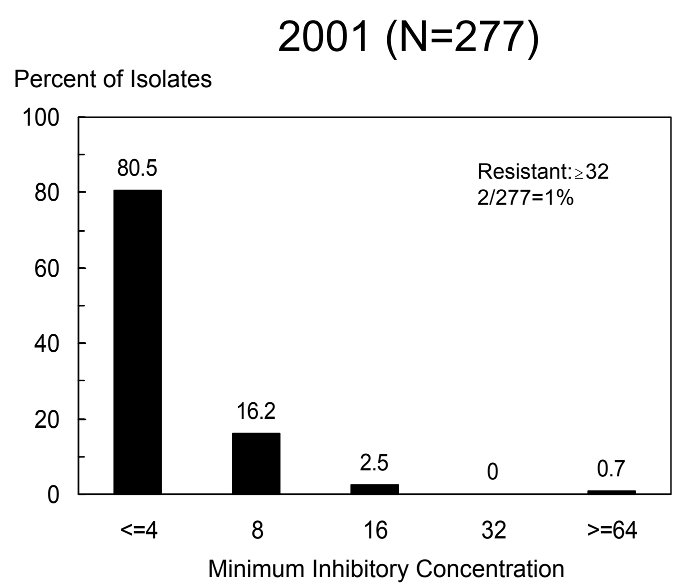
Figure 18e. MICs for cefoxitin among *E. coli* O157 isolates, 1996-2001

Not Tested in 1996-1999





National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 18f. MICs for ceftiofur among *E. coli* O157 isolates, 1996-2001

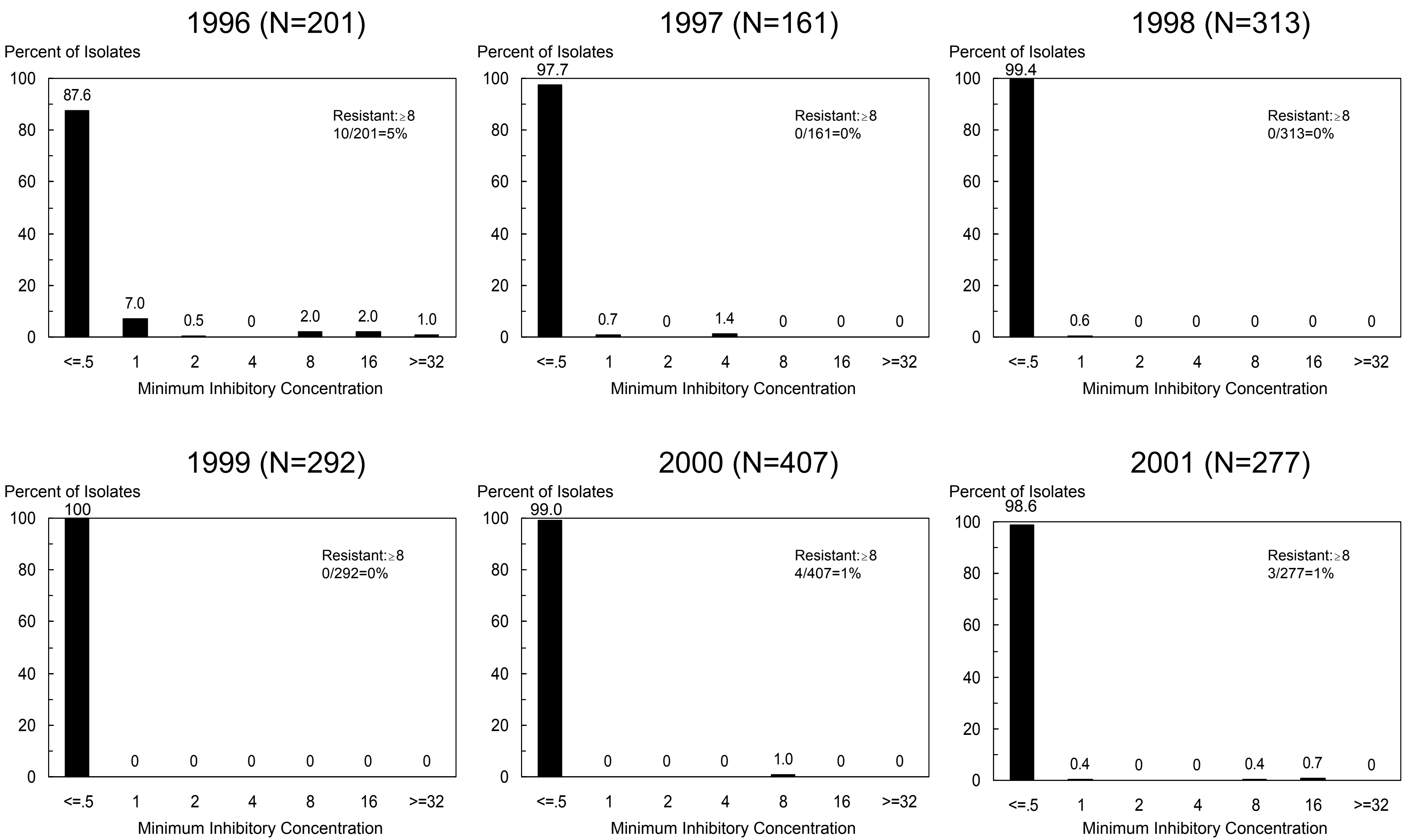


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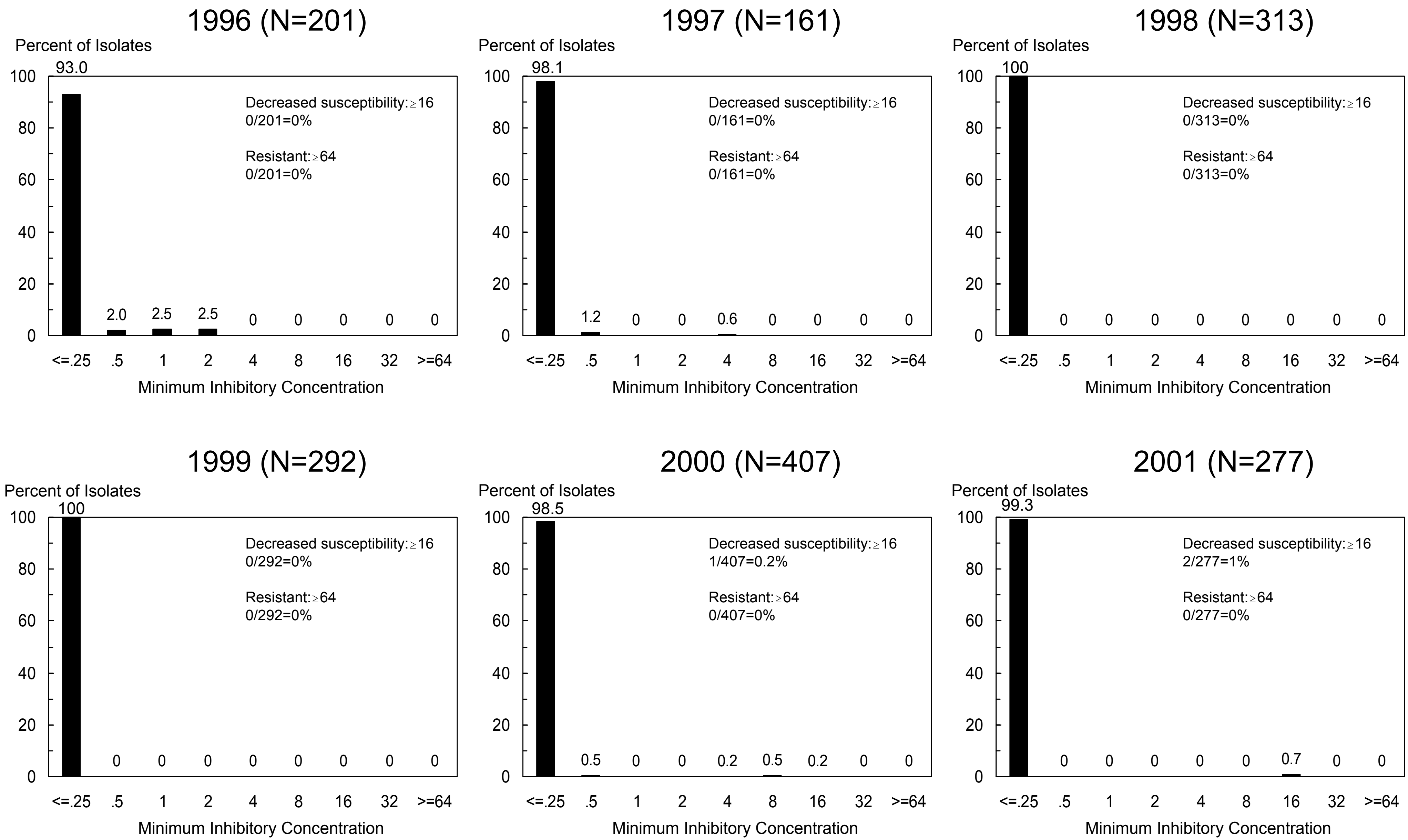
Figure 18g. MICs for ceftriaxone* among *E. coli* O157 isolates, 1996-2001



*Sensititre® results only

National Antimicrobial Resistance Monitoring System For Enteric Bacteria

Figure 18h. MICs for cephalothin among *E. coli* O157 isolates, 1996-2001

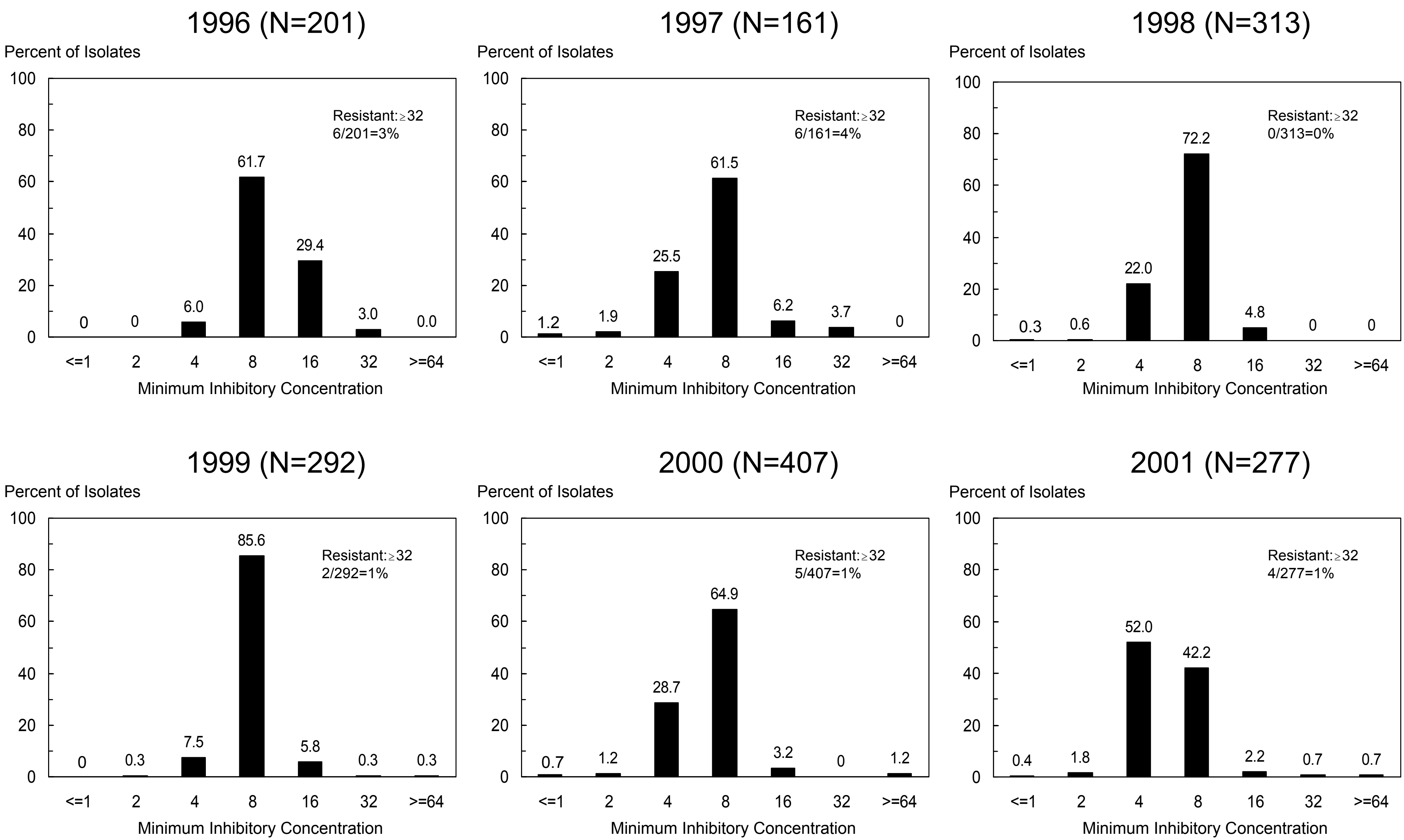


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Figure 18i. MICs for chloramphenicol among *E. coli* O157 isolates, 1996-2001

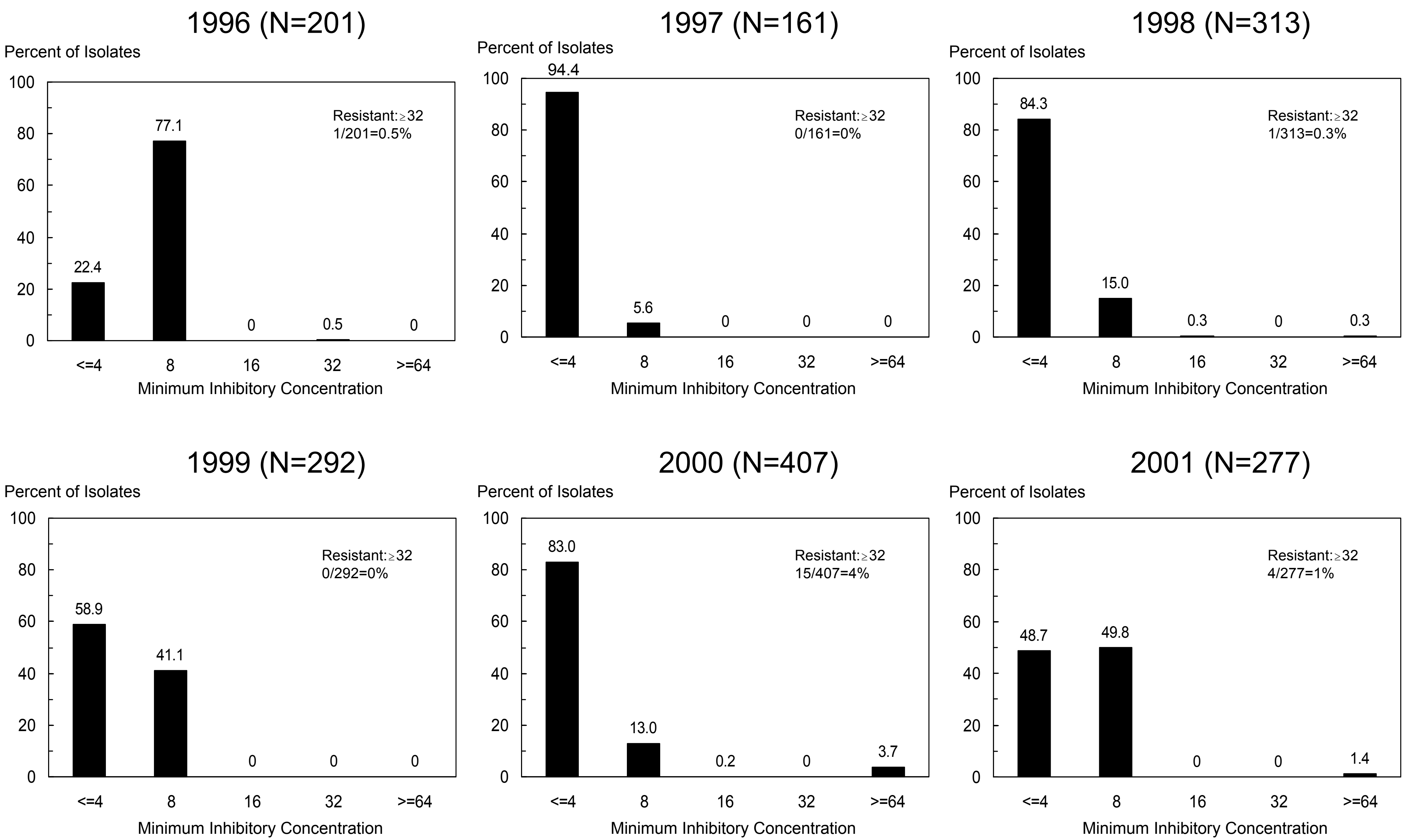

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Figure 18j. MICs for ciprofloxacin among *E. coli* O157 isolates, 1996-2001

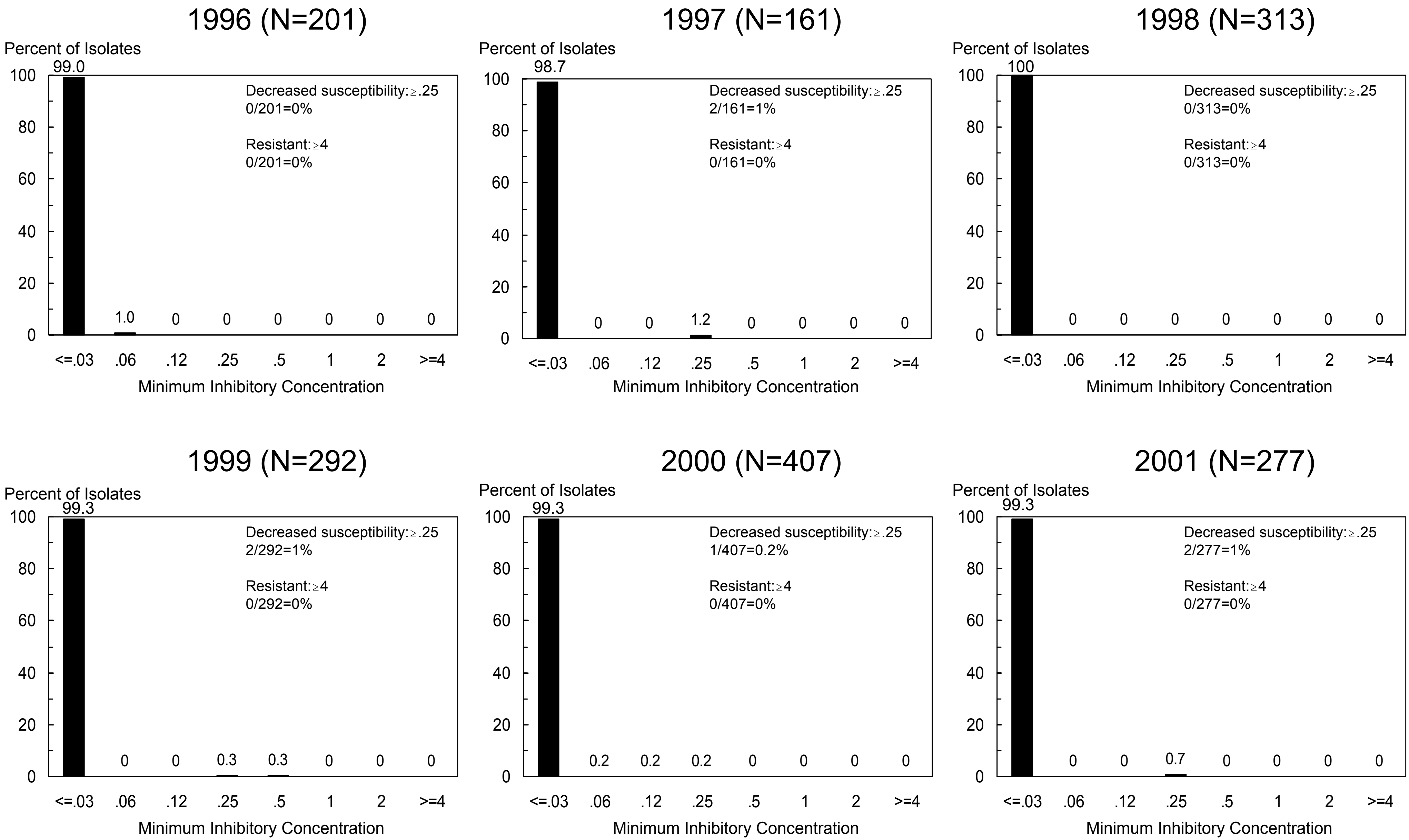

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Figure 18k. MICs for gentamicin among *E. coli* O157 isolates, 1996-2001

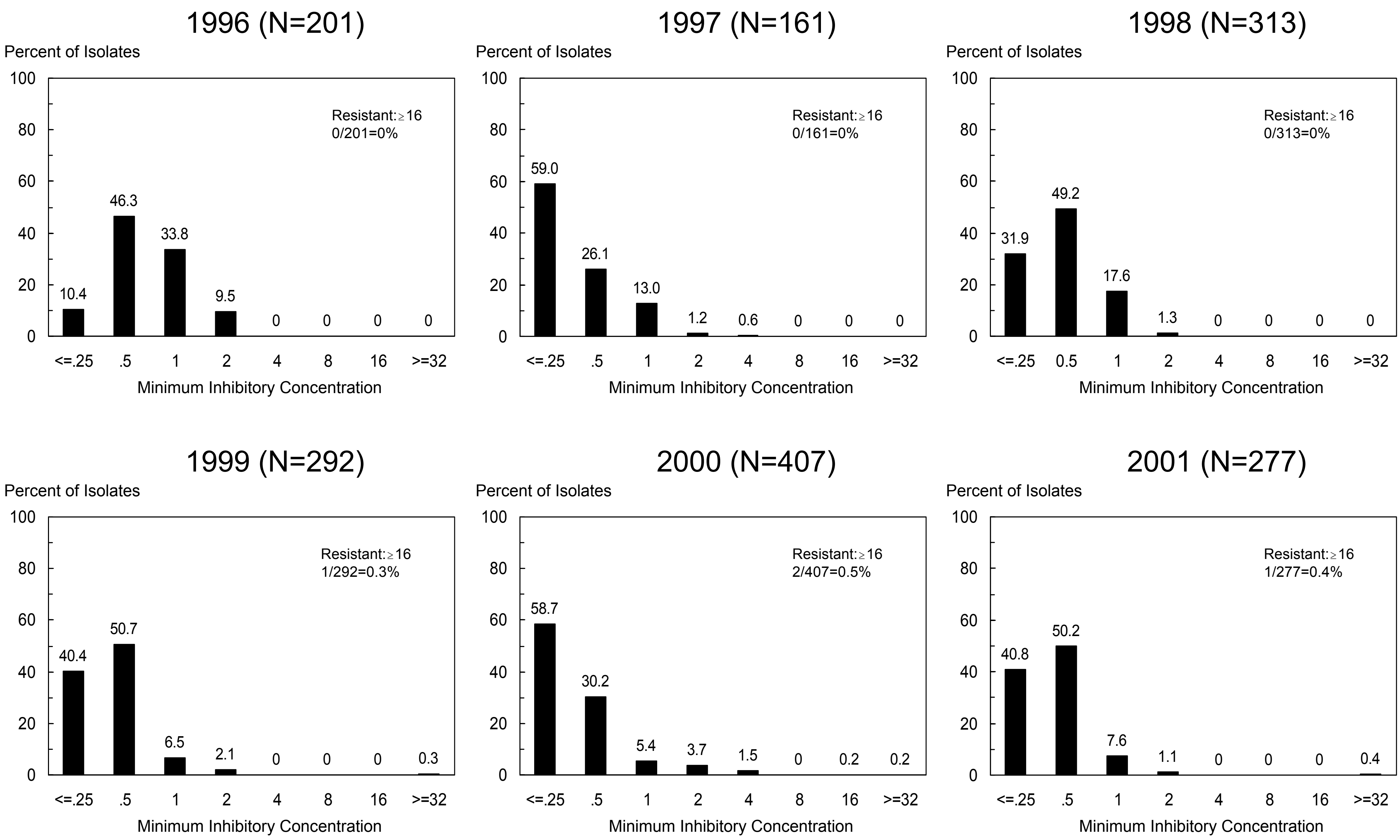

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Figure 18I. MICs for kanamycin among *E. coli* O157 isolates, 1996-2001

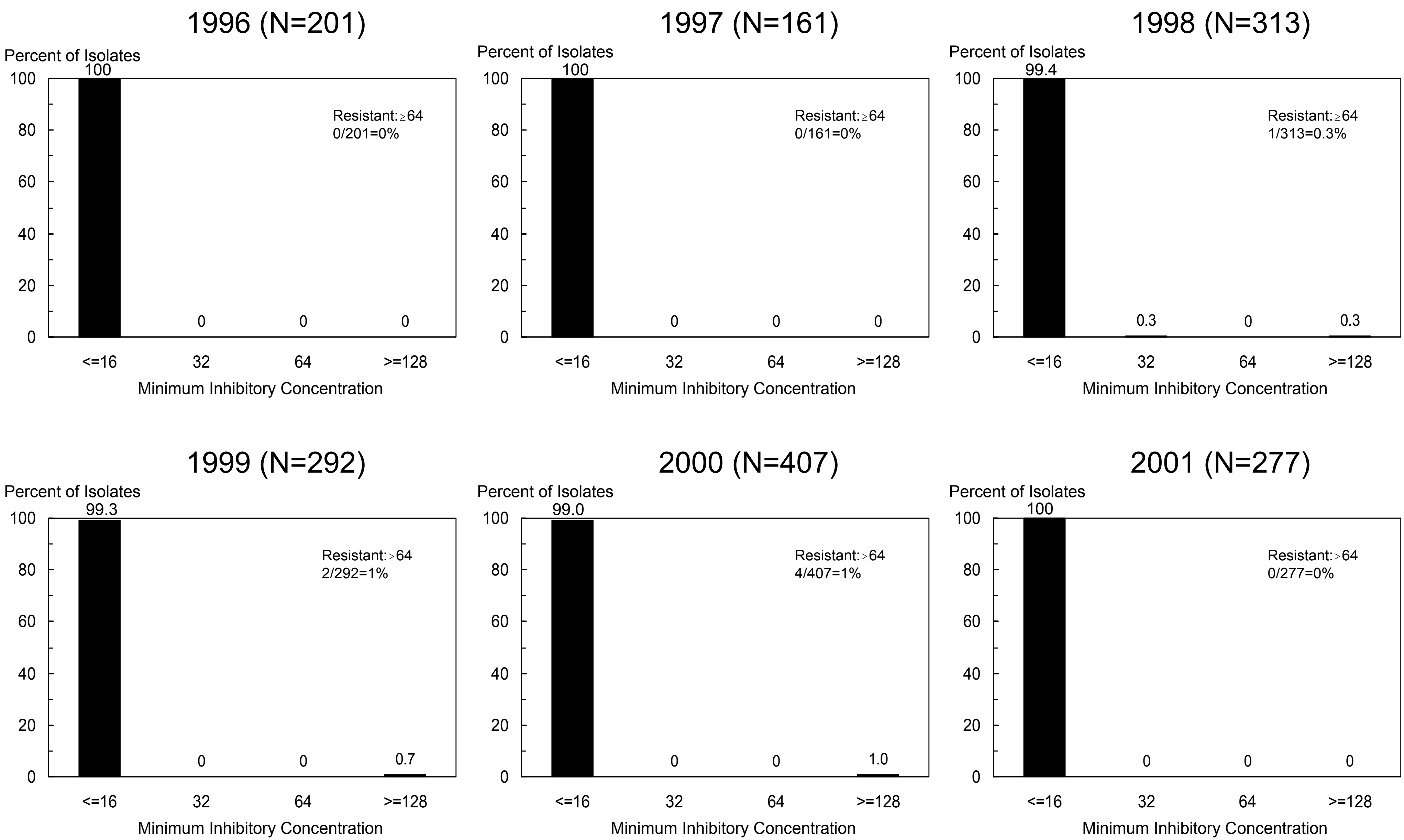

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Figure 18m. MICs for nalidixic acid among *E. coli* O157 isolates, 1996-2001

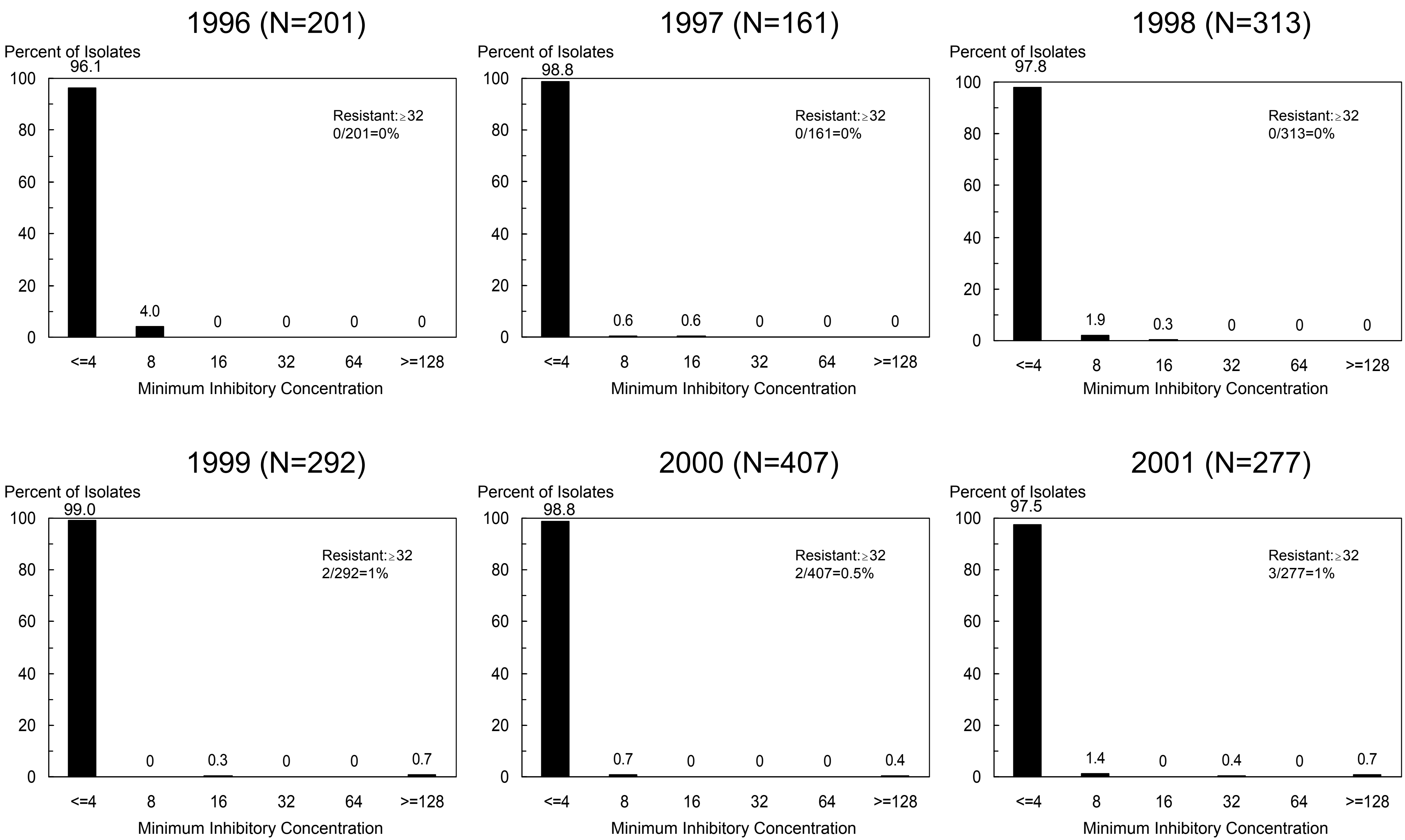

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Figure 18n. MICs for streptomycin among *E. coli* O157 isolates, 1996-2001

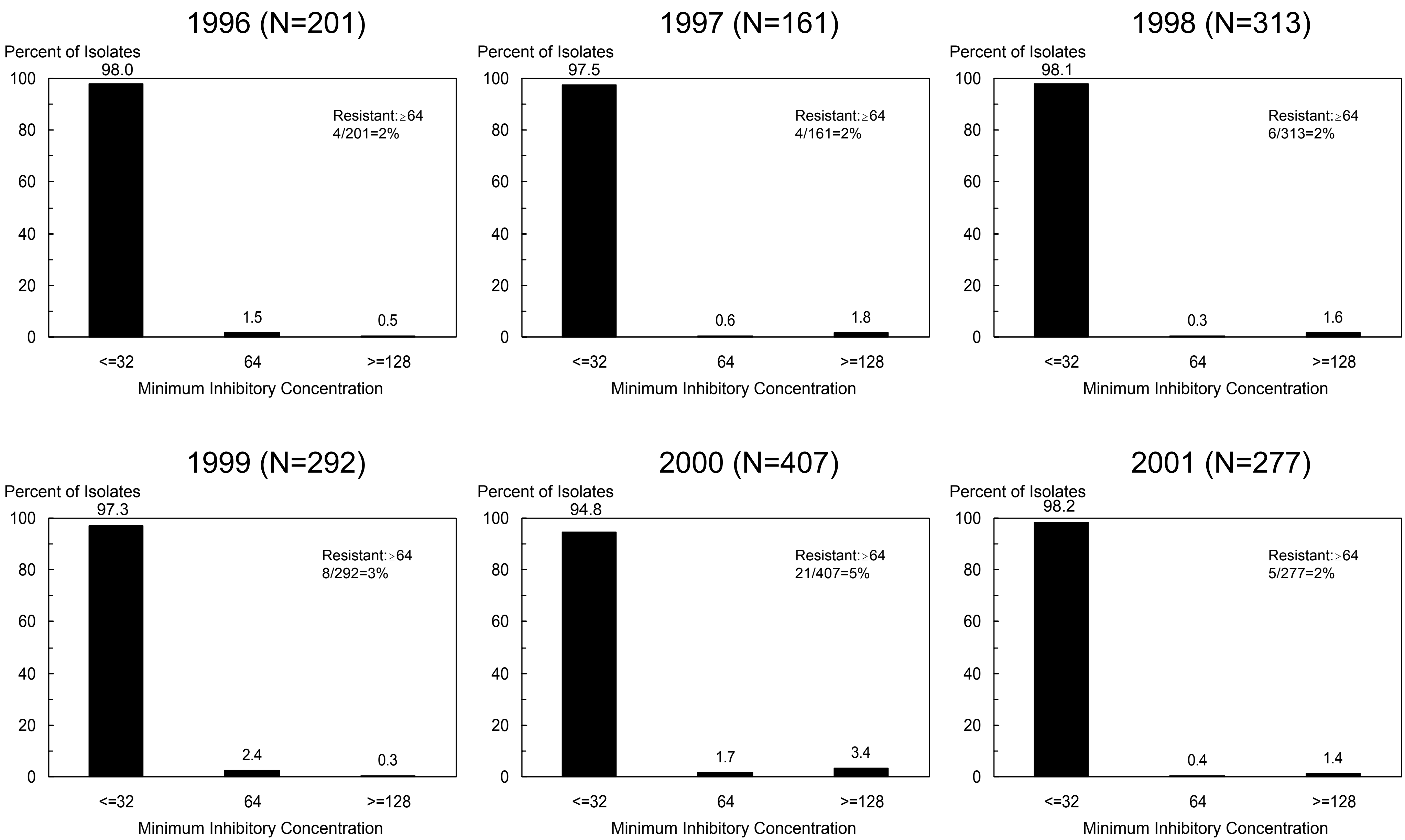

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Figure 18o. MICs for sulfamethoxazole among *E. coli* O157 isolates, 1996-2001

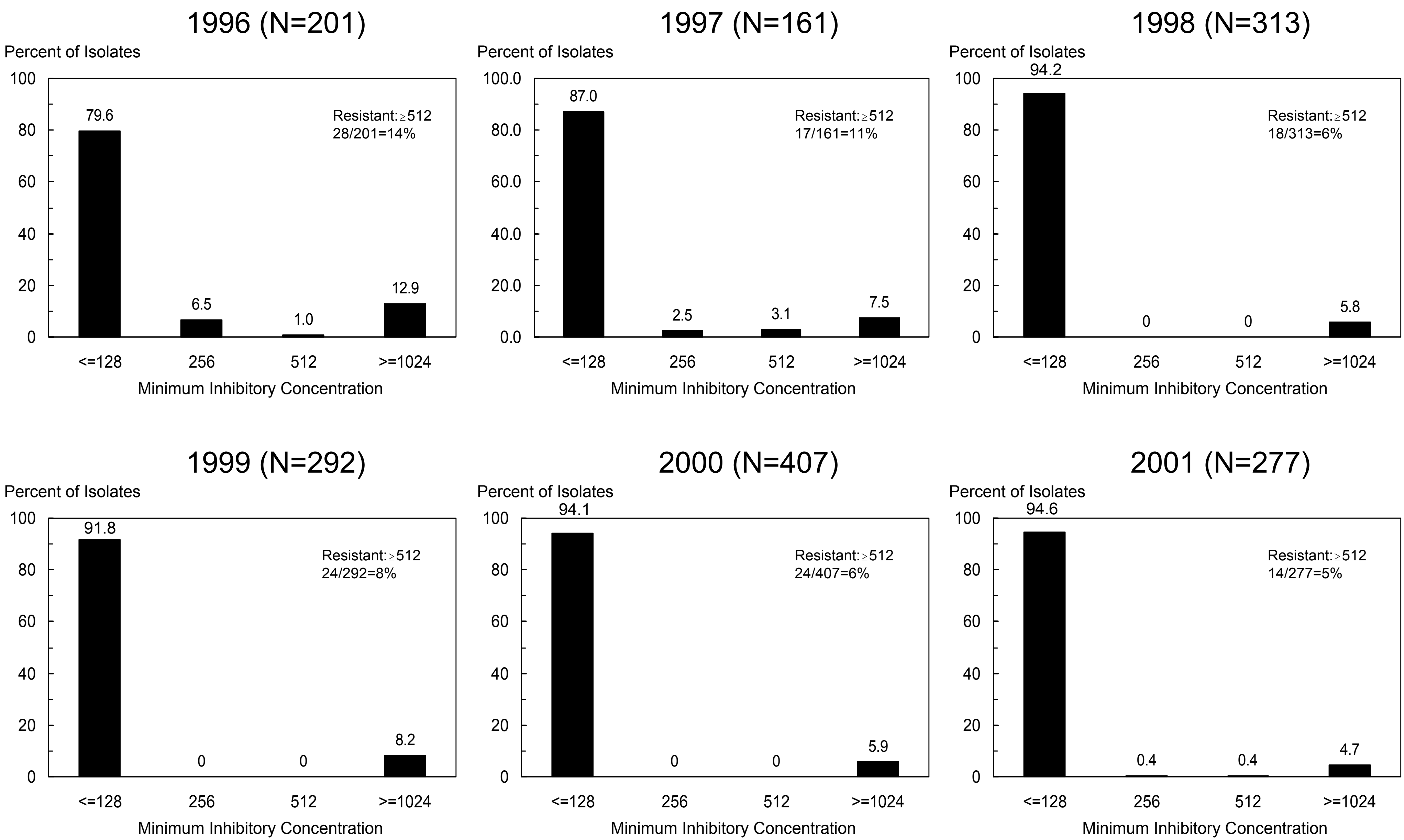

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Figure 18p. MICs for tetracycline among *E. coli* O157 isolates, 1996-2001

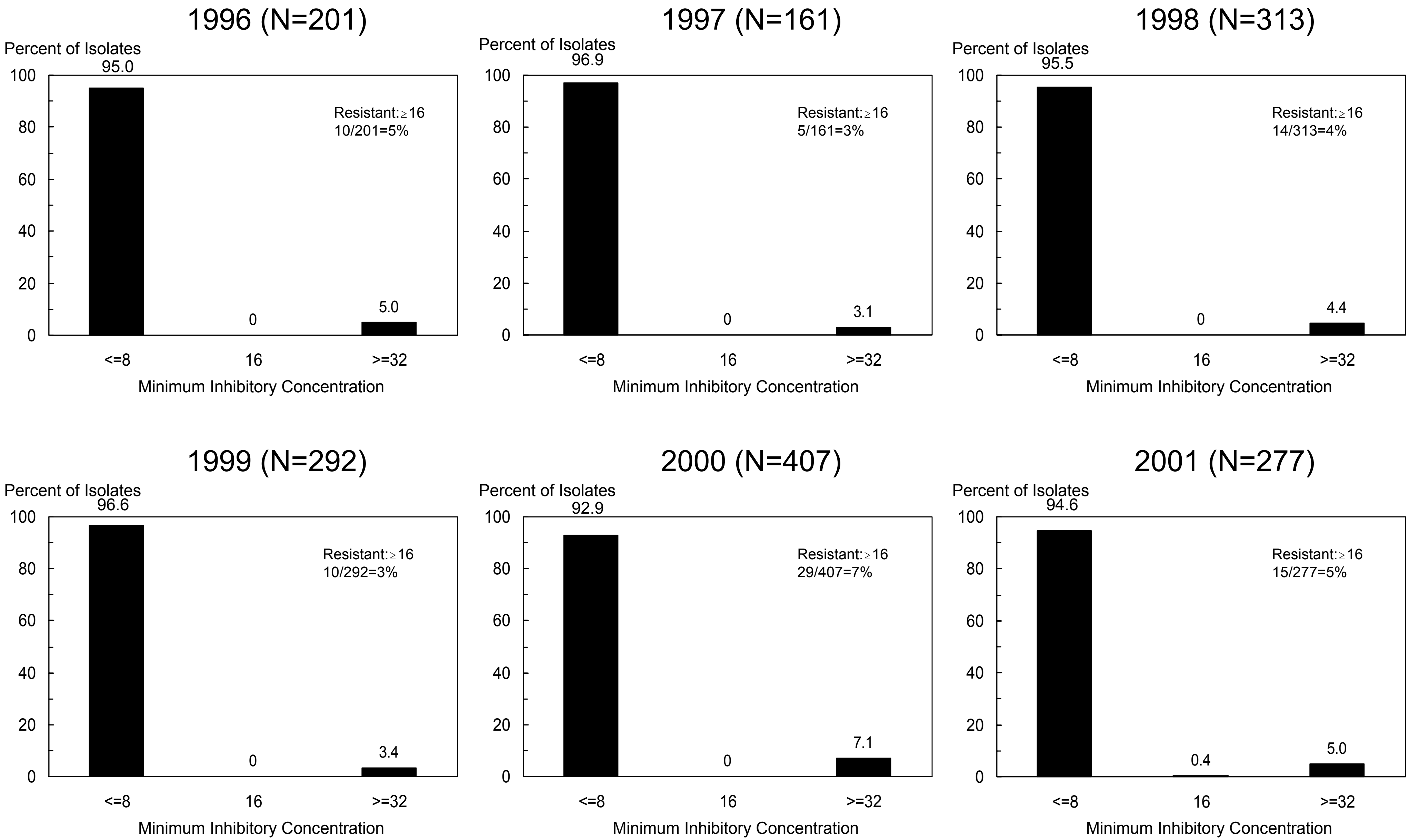

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Figure 18q. MICs for trimethoprim-sulfamethoxazole among *E. coli* O157 isolates, 1996-2001

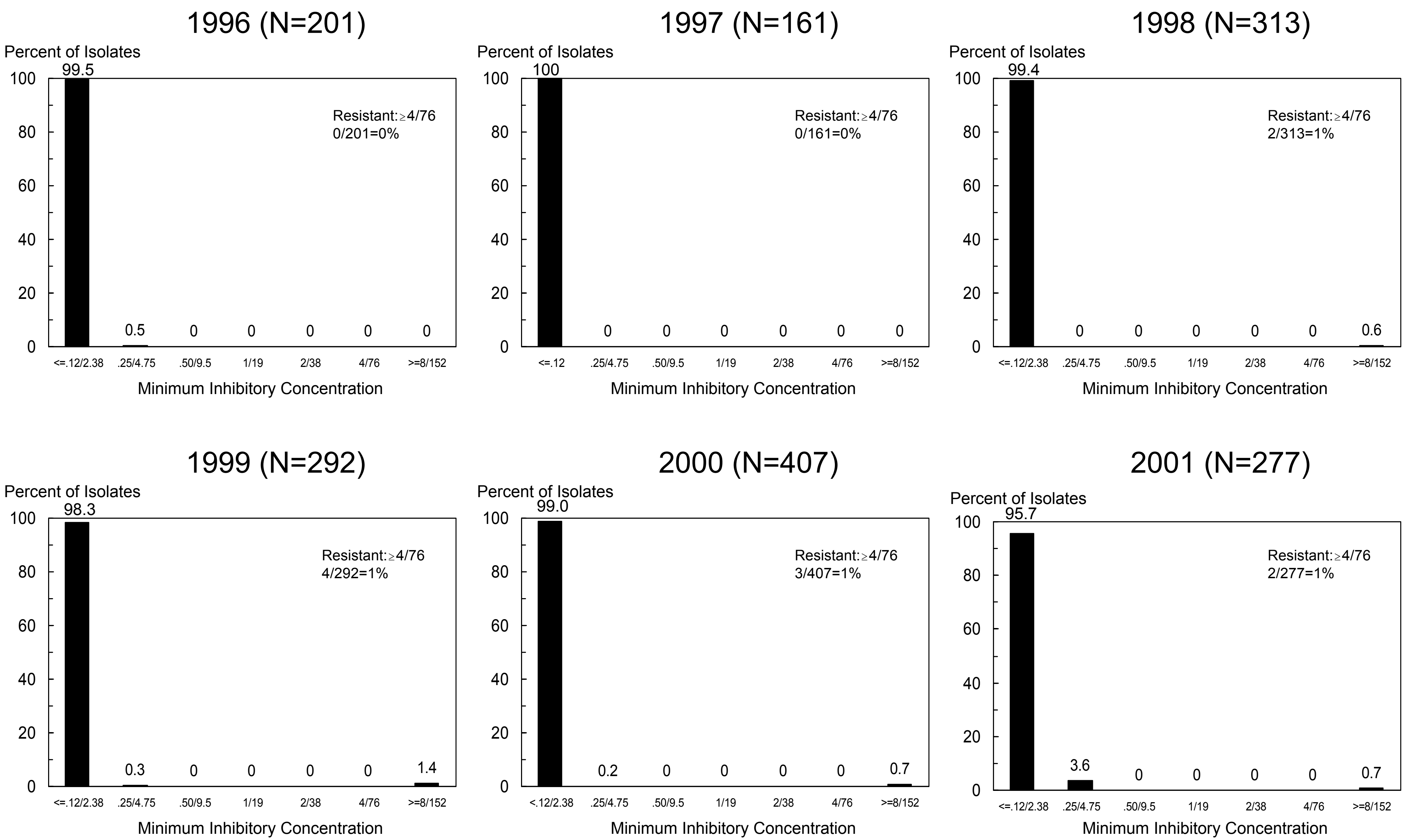

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Figure 19. Resistance among *Campylobacter* isolates, 1997-2001

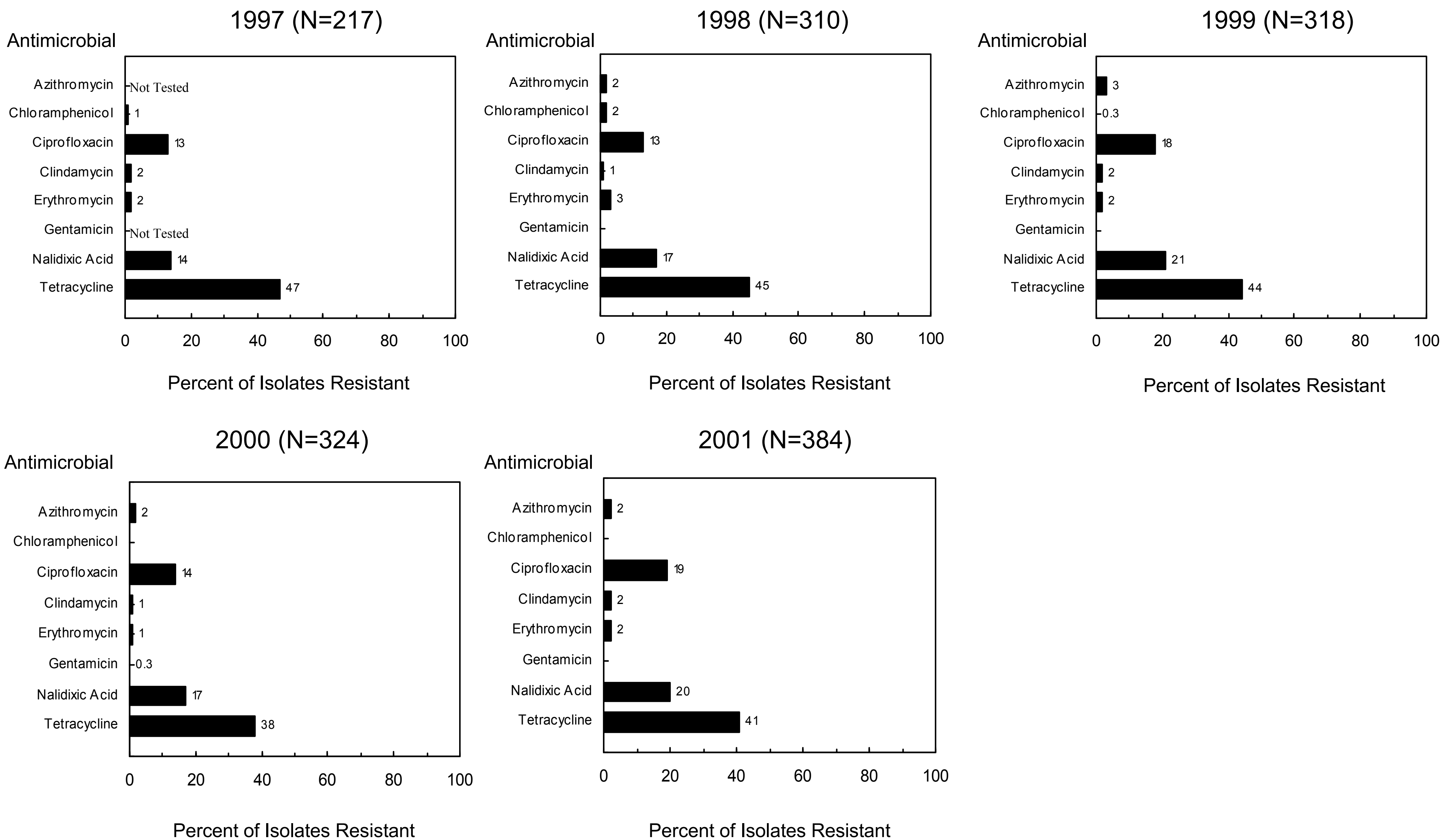

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Figure 20a. Resistance among *Campylobacter jejuni* isolates, 1997-2001

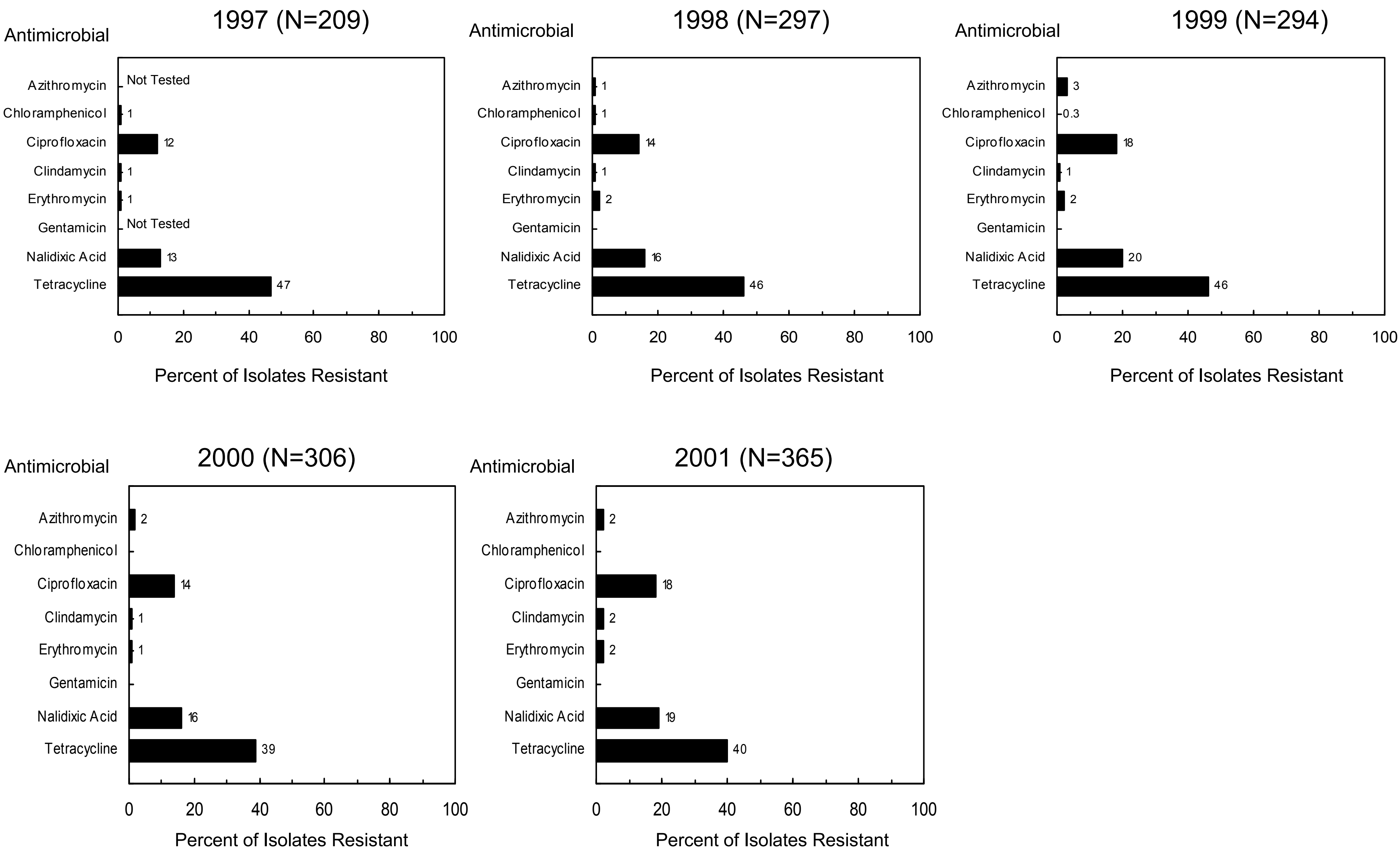

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Figure 20b. Resistance among *Campylobacter coli* isolates, 1997-2001

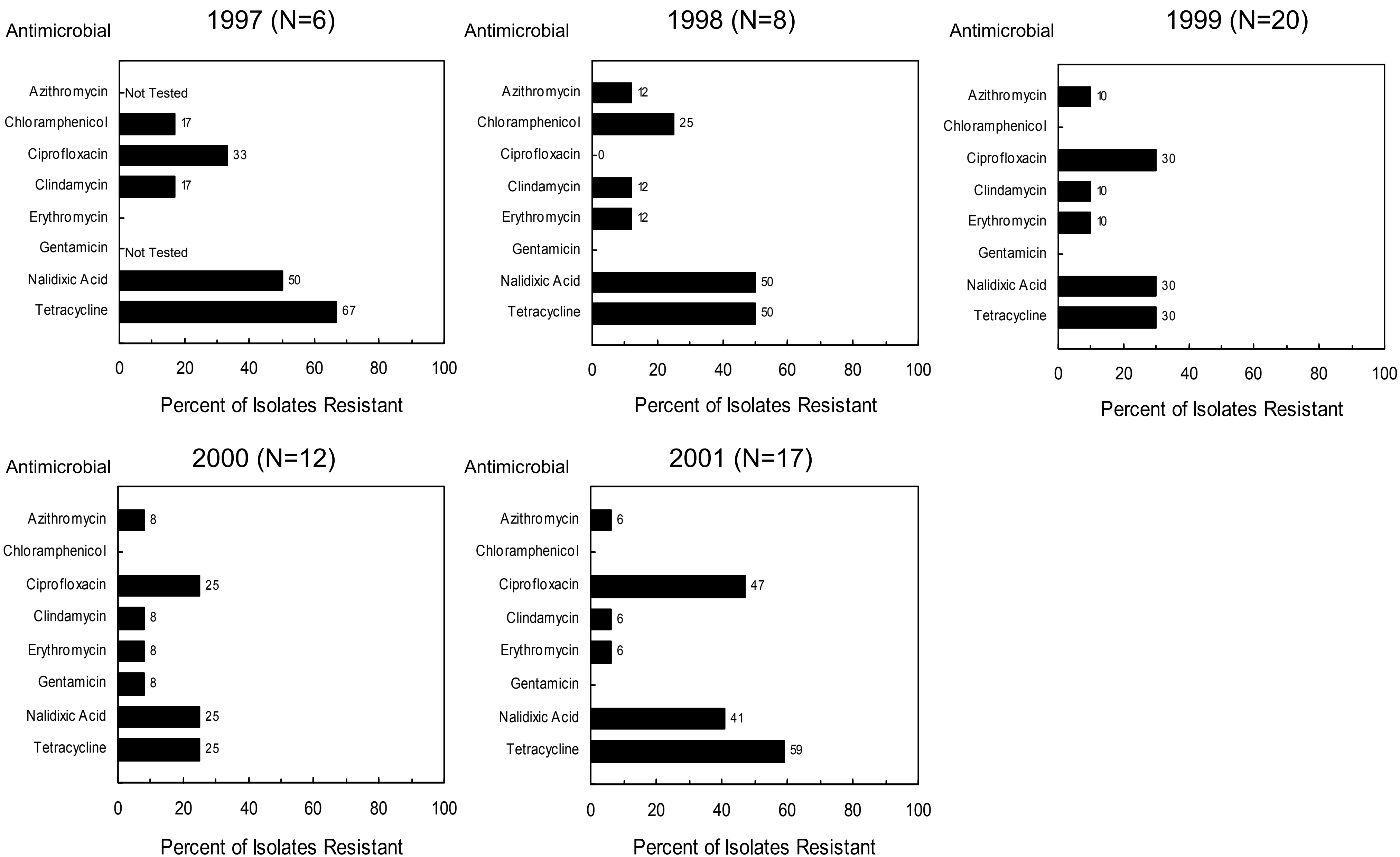

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Figure 21a. MICs for azithromycin among *Campylobacter jejuni* isolates, 1997-2001

Not Tested in 1997

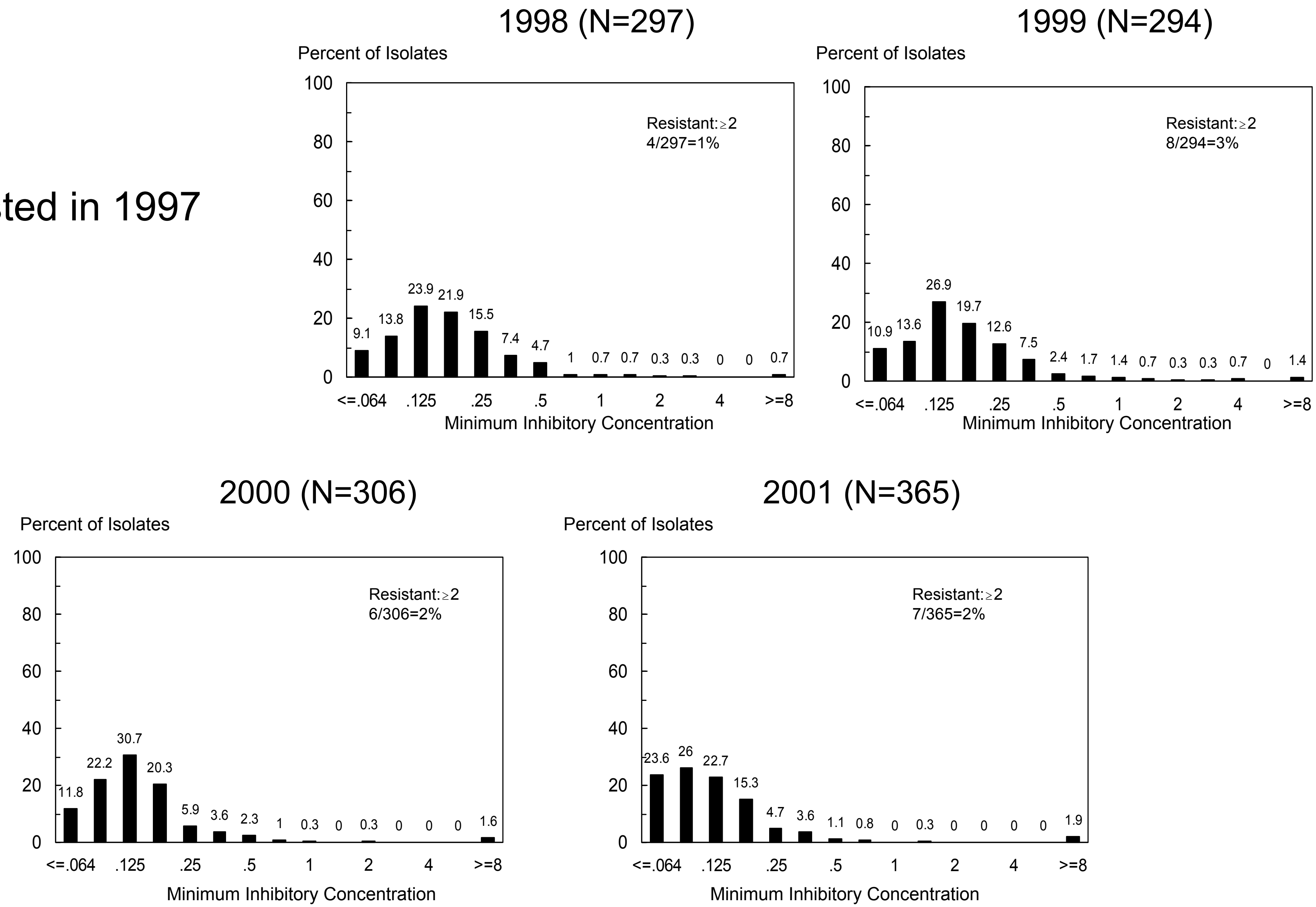

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Figure 21b. MICs for chloramphenicol among *Campylobacter jejuni* isolates, 1997-2001

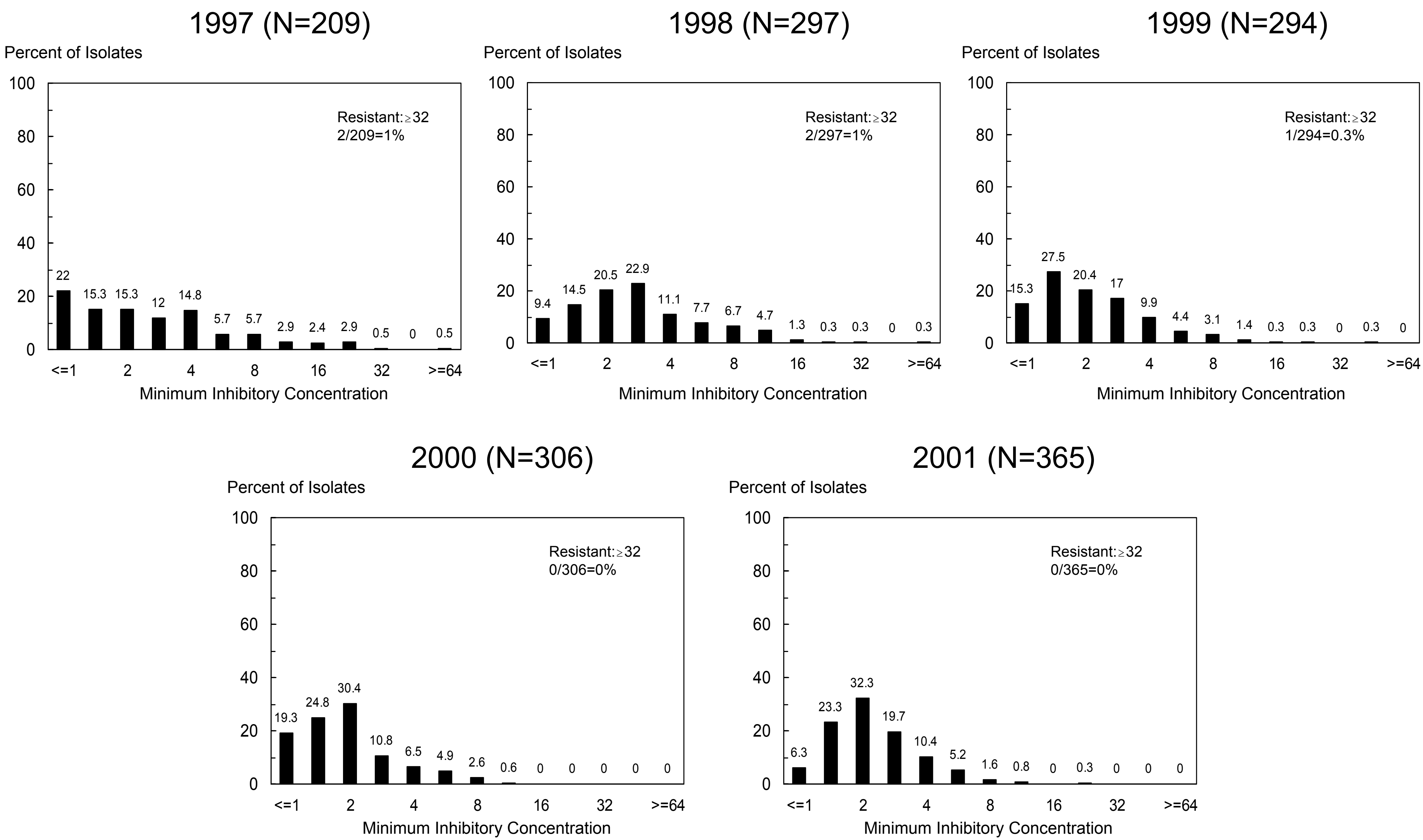

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Figure 21c. MICs for ciprofloxacin among *Campylobacter jejuni* isolates, 1997-2001

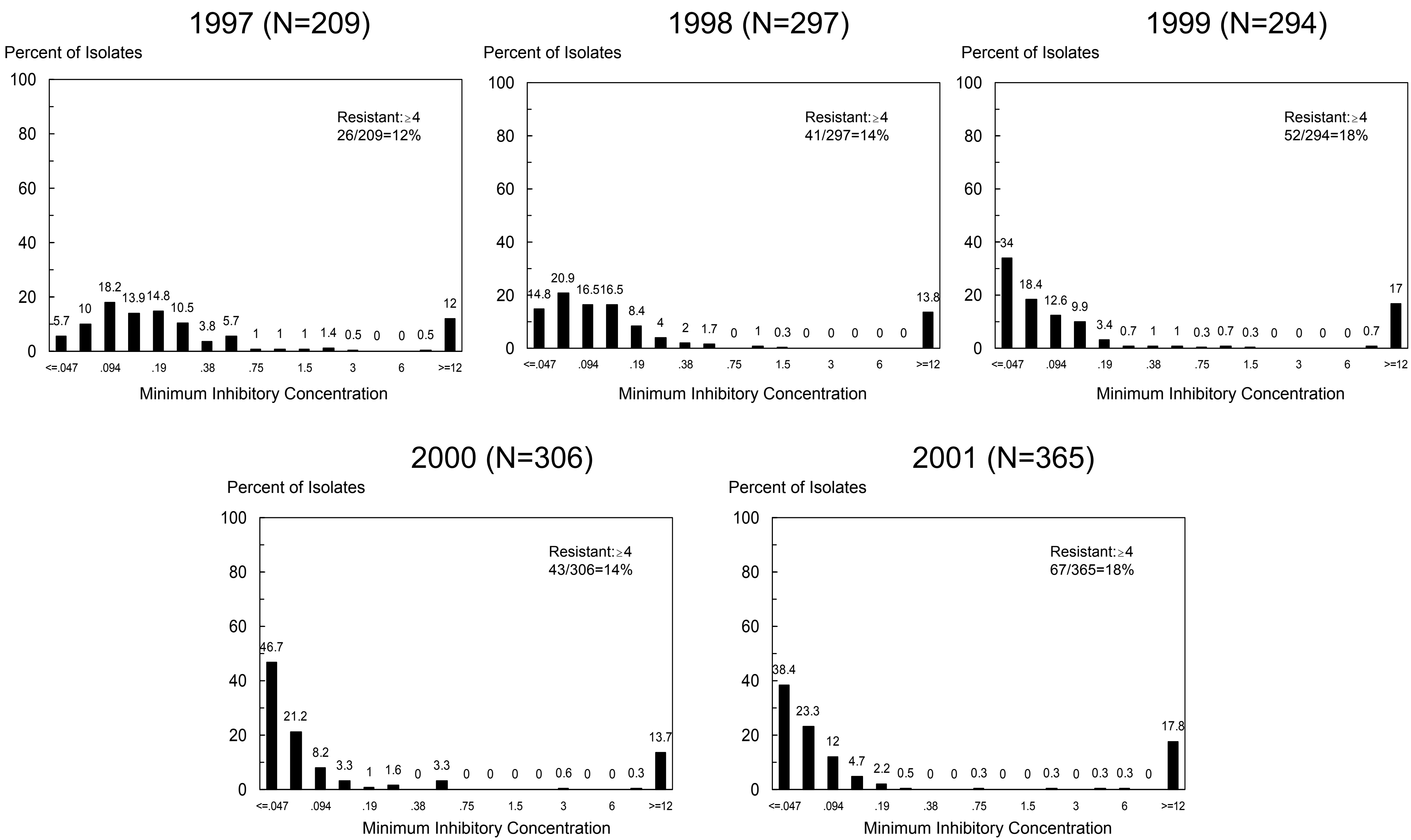

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Figure 21d. MICs for clindamycin among *Campylobacter jejuni* isolates, 1997-2001

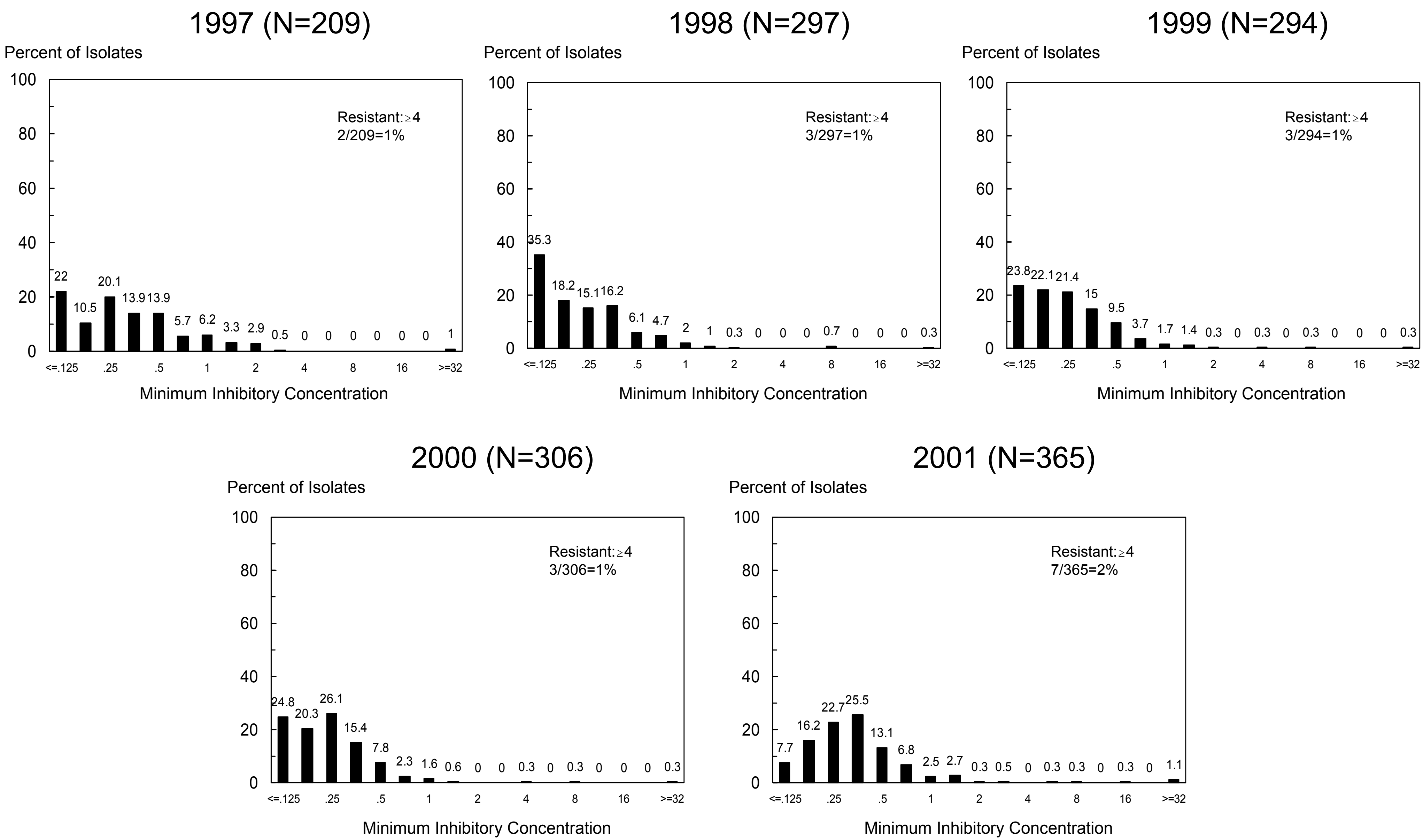

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Figure 21e. MICs for erythromycin among *Campylobacter jejuni* isolates, 1997-2001

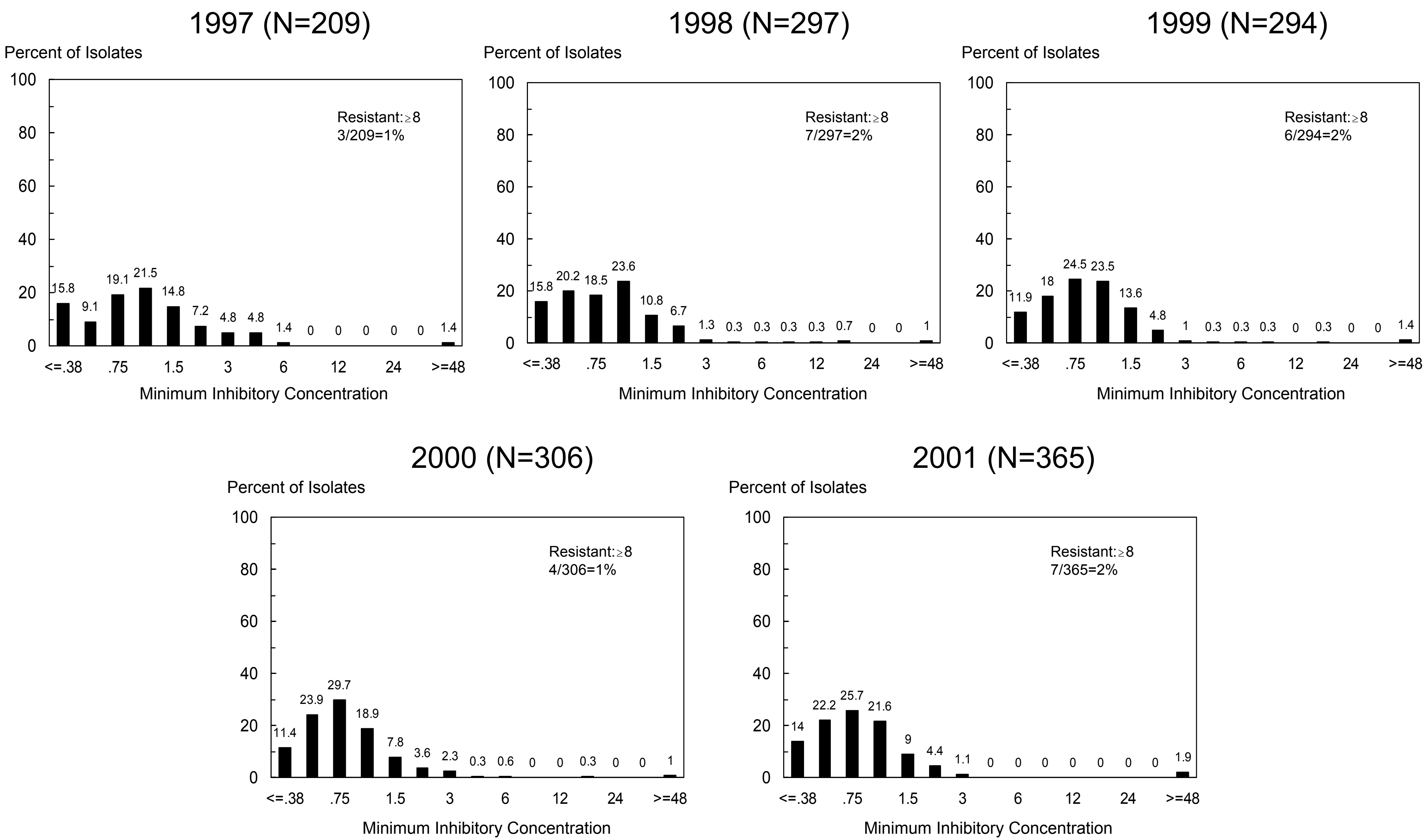

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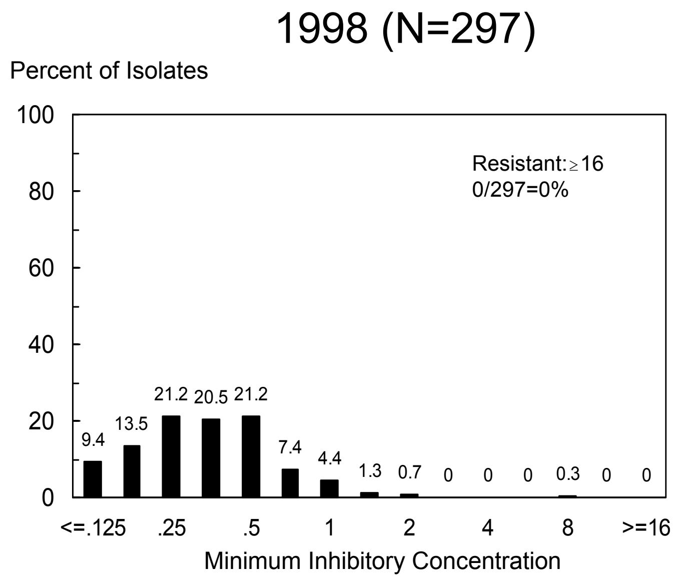
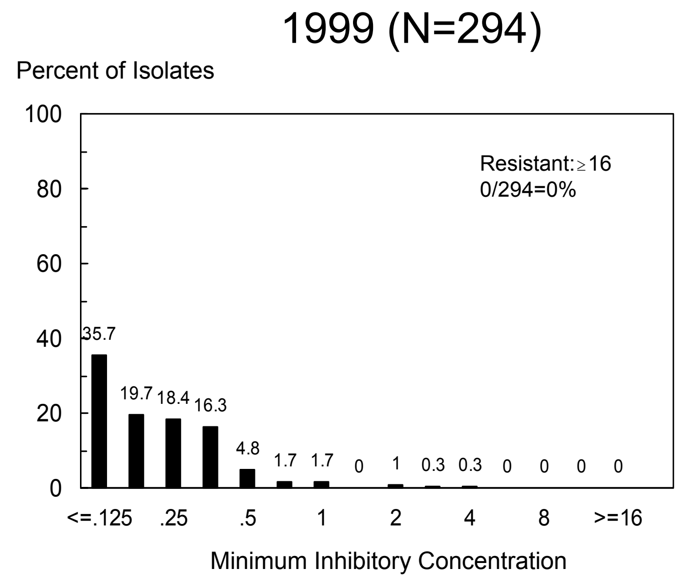
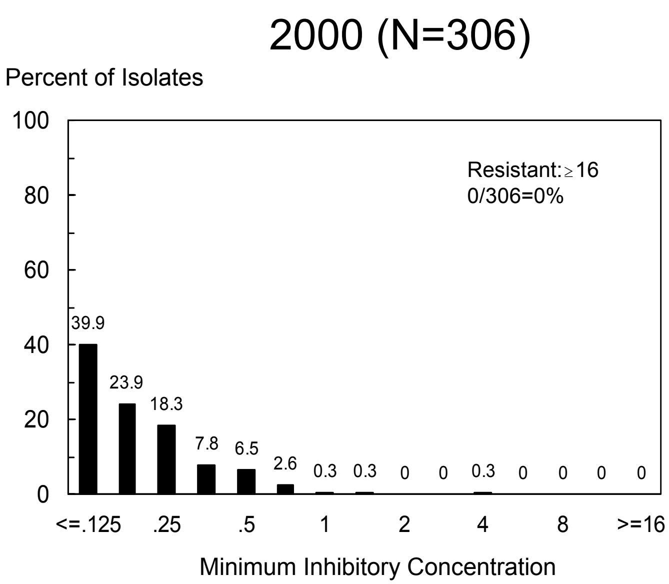
Figure 21f. MICs for gentamicin among *Campylobacter jejuni* isolates, 1997-2001

Not Tested in 1997







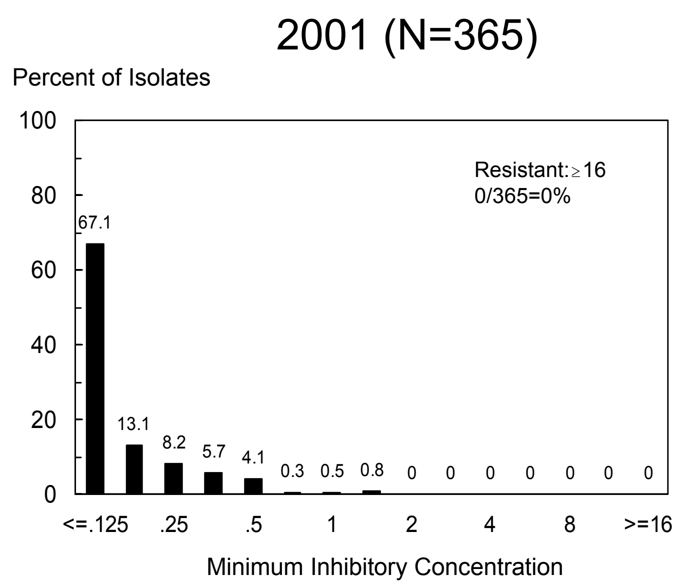


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Figure 21g. MICs for nalidixic acid among *Campylobacter jejuni* isolates, 1997-2001

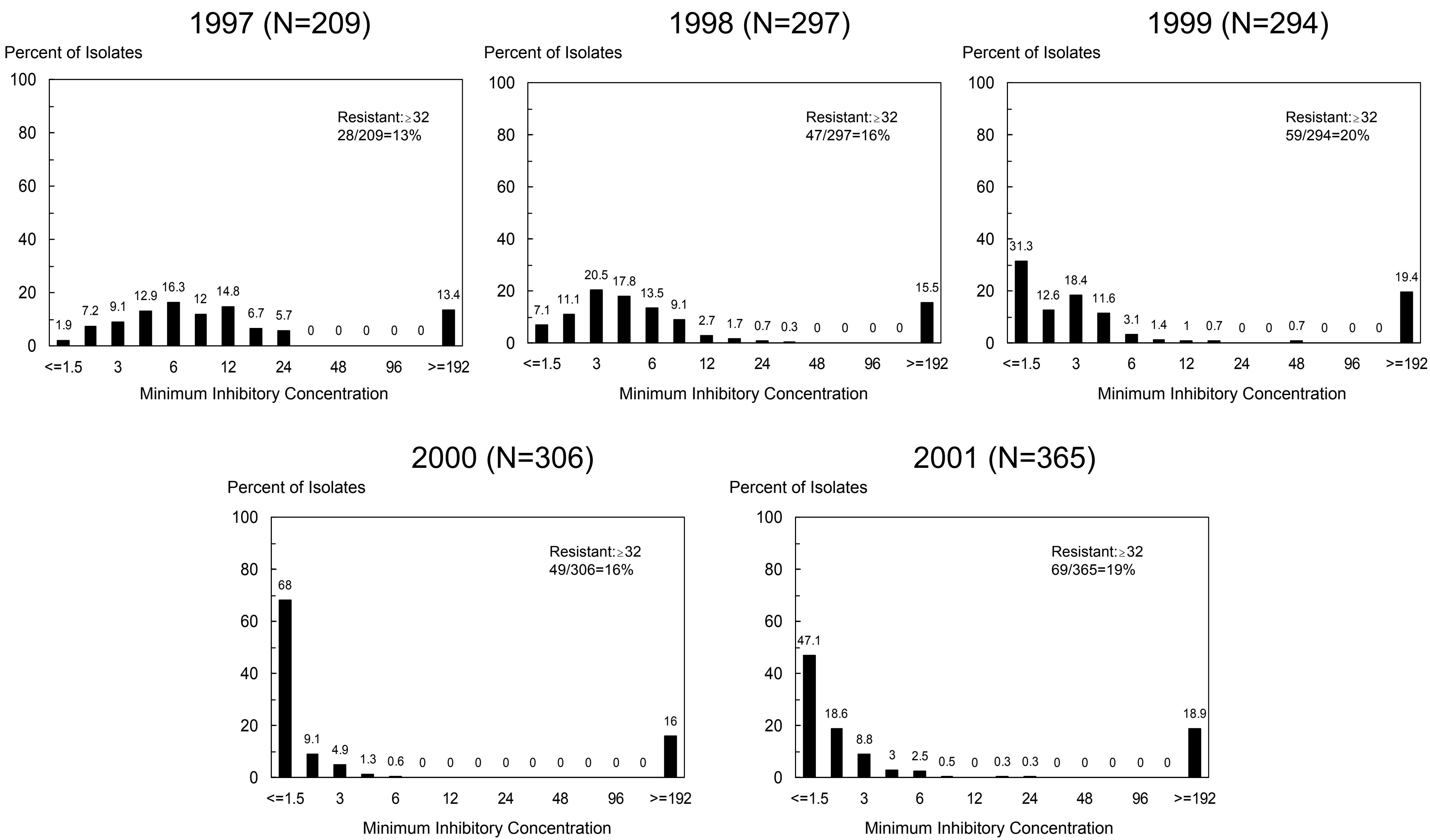

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Figure 21h. MICs for tetracycline among *Campylobacter jejuni* isolates, 1997-2001

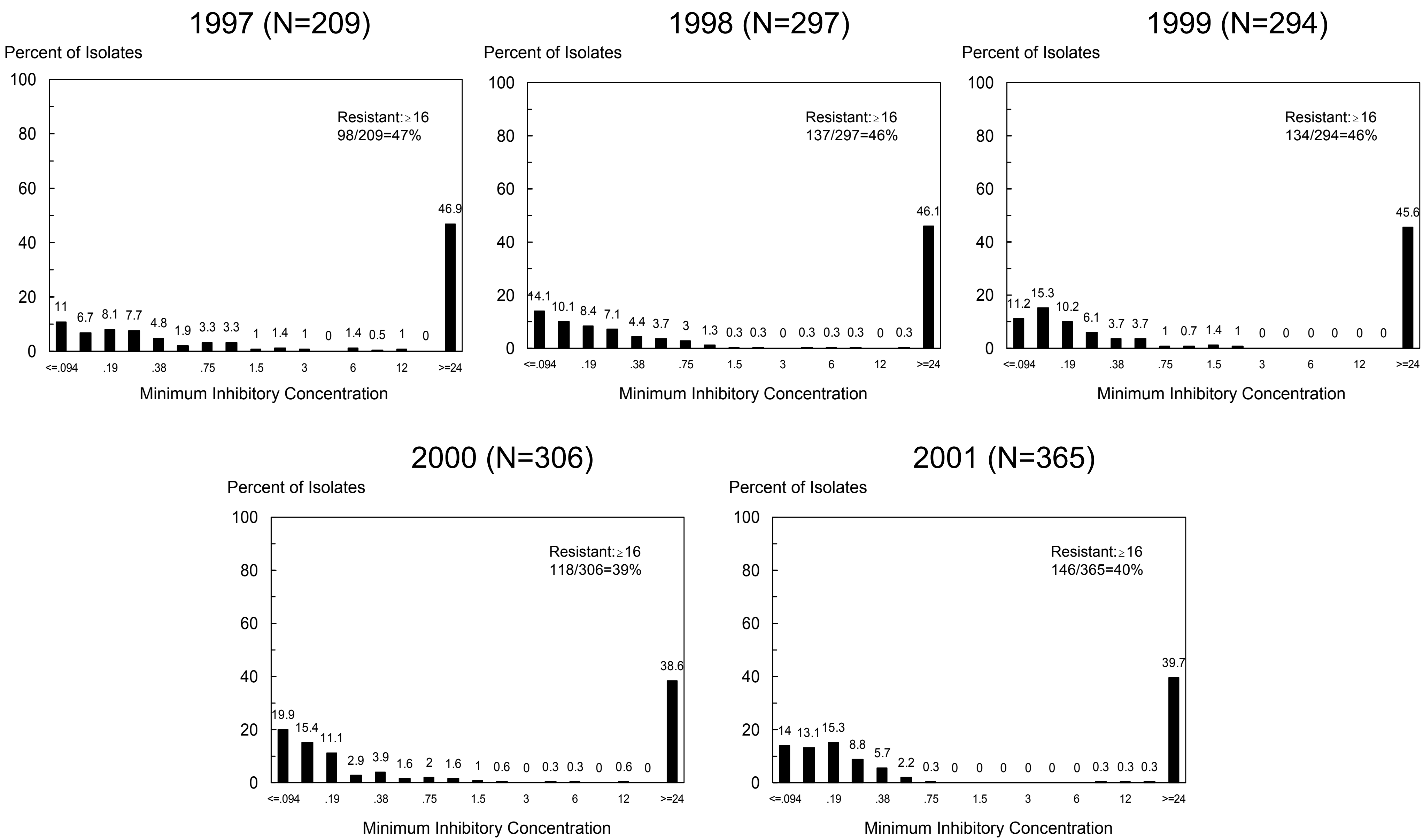

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Figure 22a. MICs for azithromycin among *Campylobacter coli* isolates, 1997-2001

Not Tested in 1997

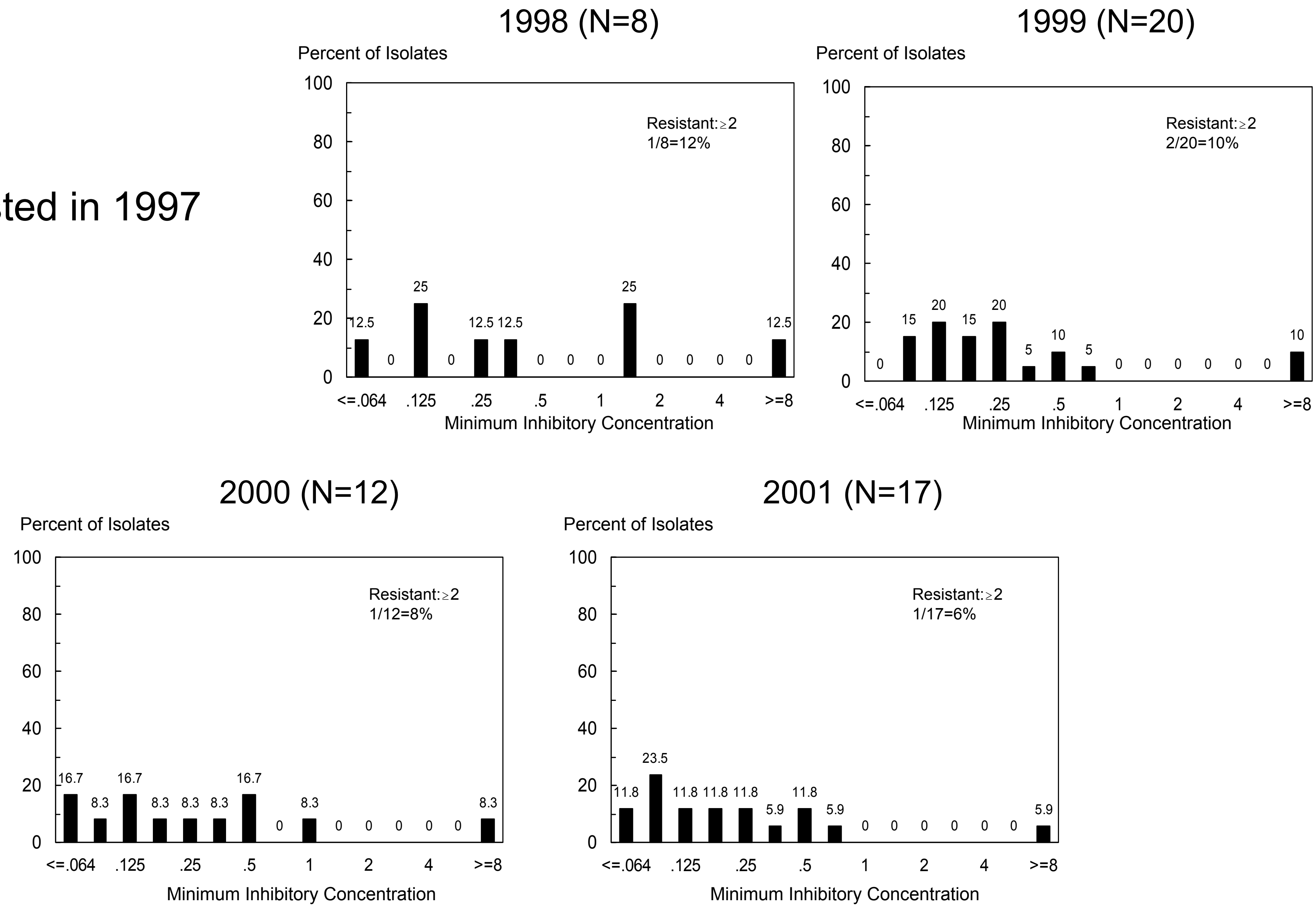

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Figure 22b. MICs for chloramphenicol among *Campylobacter coli* isolates, 1997-2001

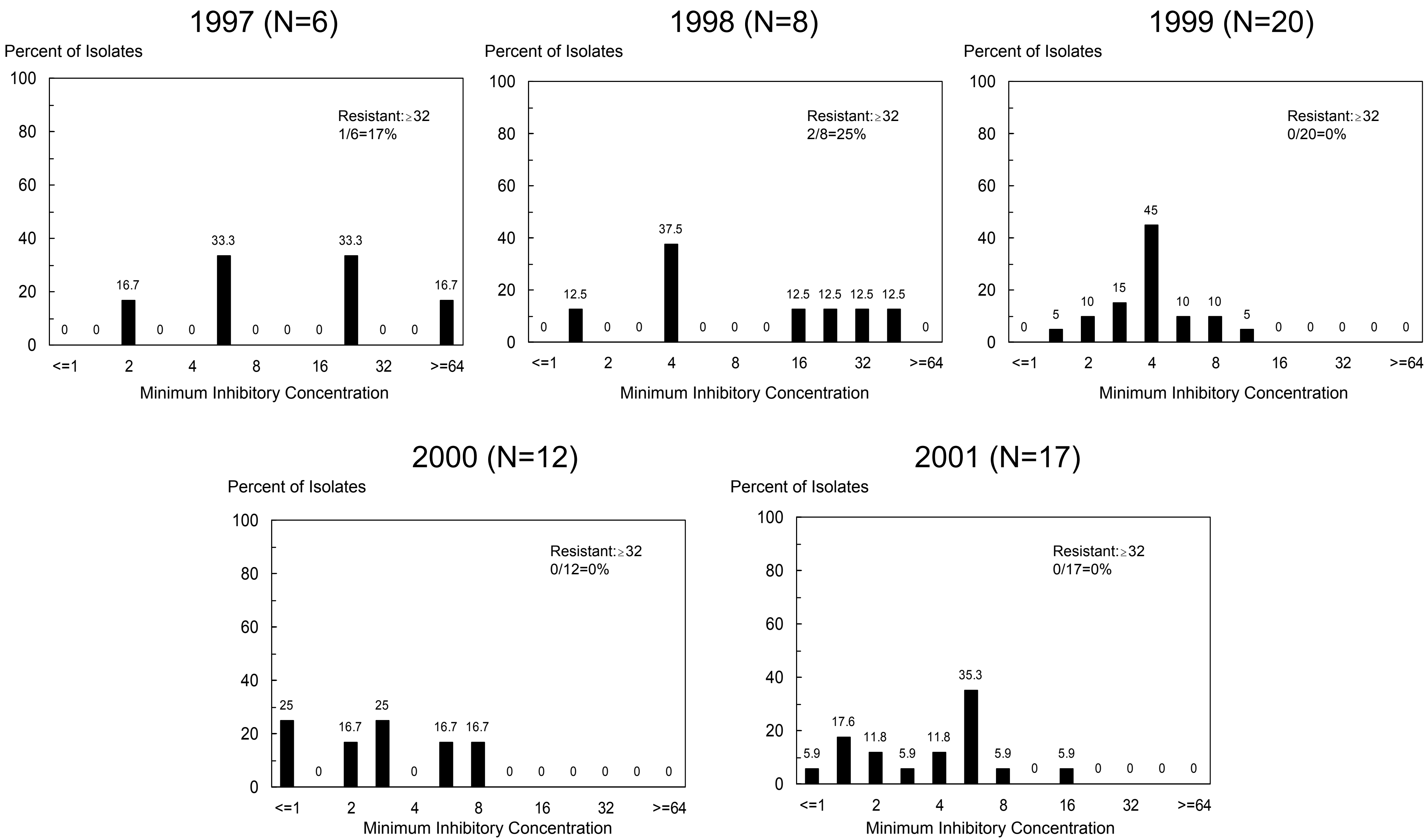

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Figure 22c. MICs for ciprofloxacin among *Campylobacter coli* isolates, 1997-2001

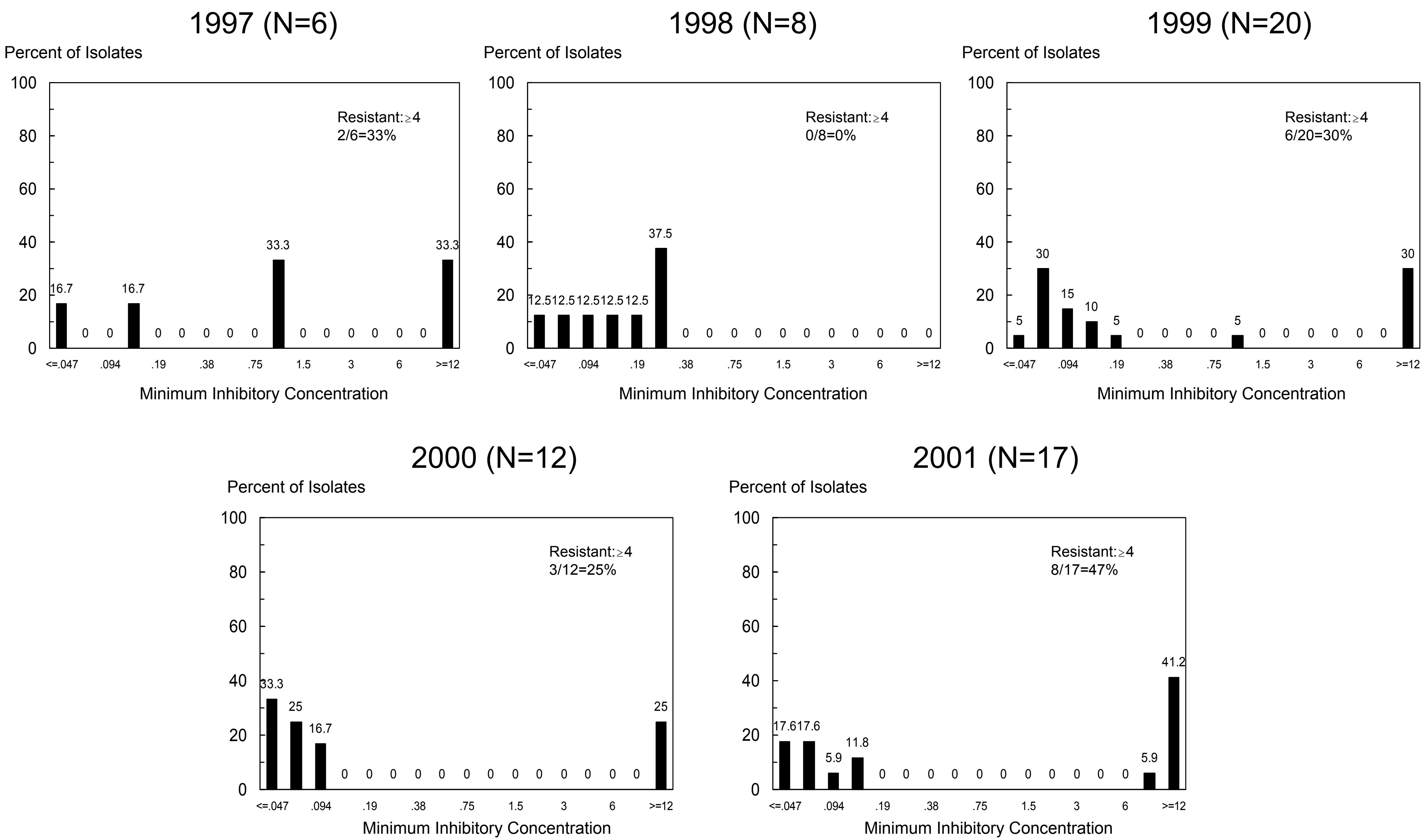

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Figure 22d. MICs for clindamycin among *Campylobacter coli* isolates, 1997-2001

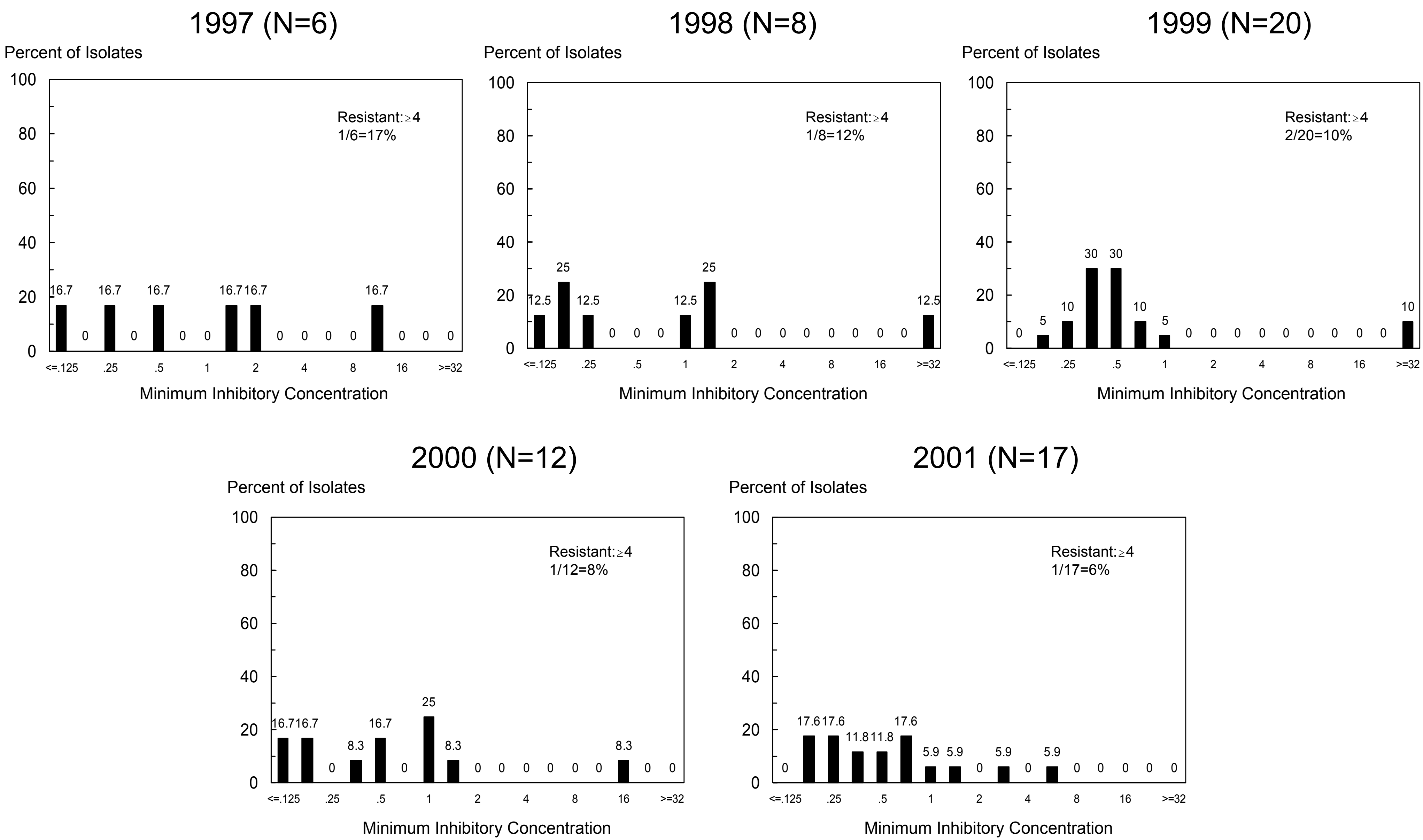

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Figure 22e. MICs for erythromycin among *Campylobacter coli* isolates, 1997-2001

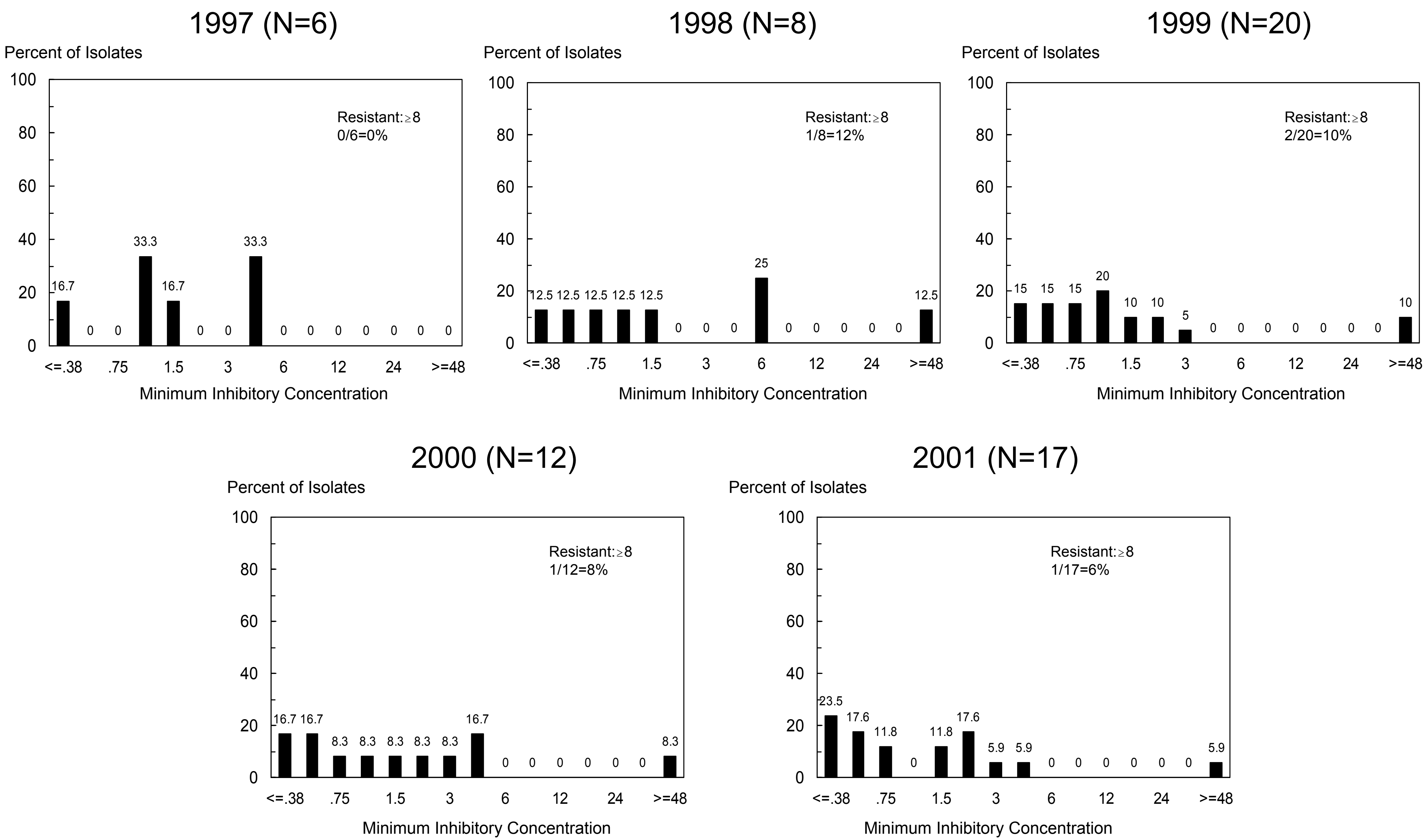

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Figure 22f. MICs for gentamicin among *Campylobacter coli* isolates, 1997-2001

Not Tested in 1997

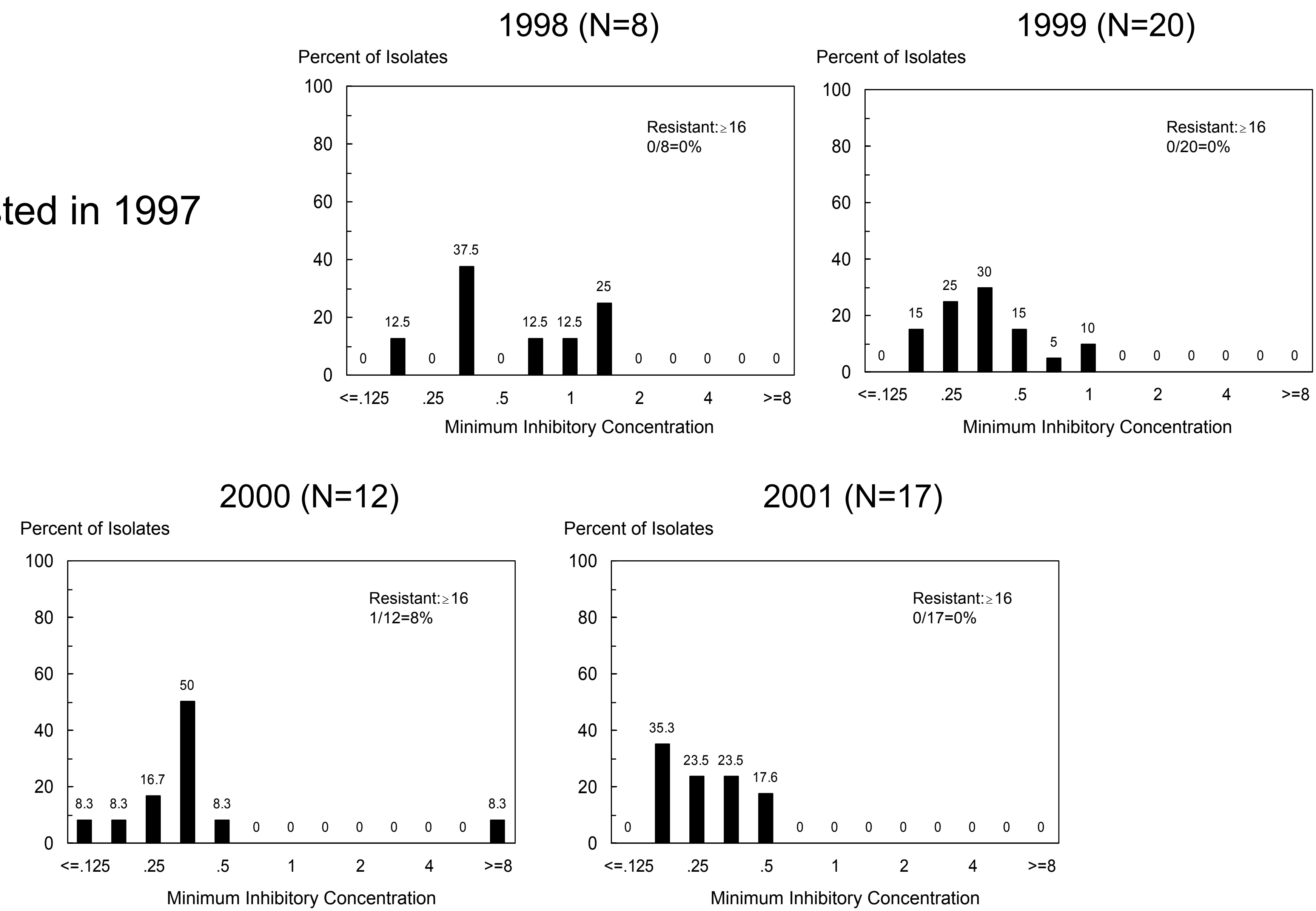

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Figure 22g. MICs for nalidixic acid among *Campylobacter coli* isolates, 1997-2001

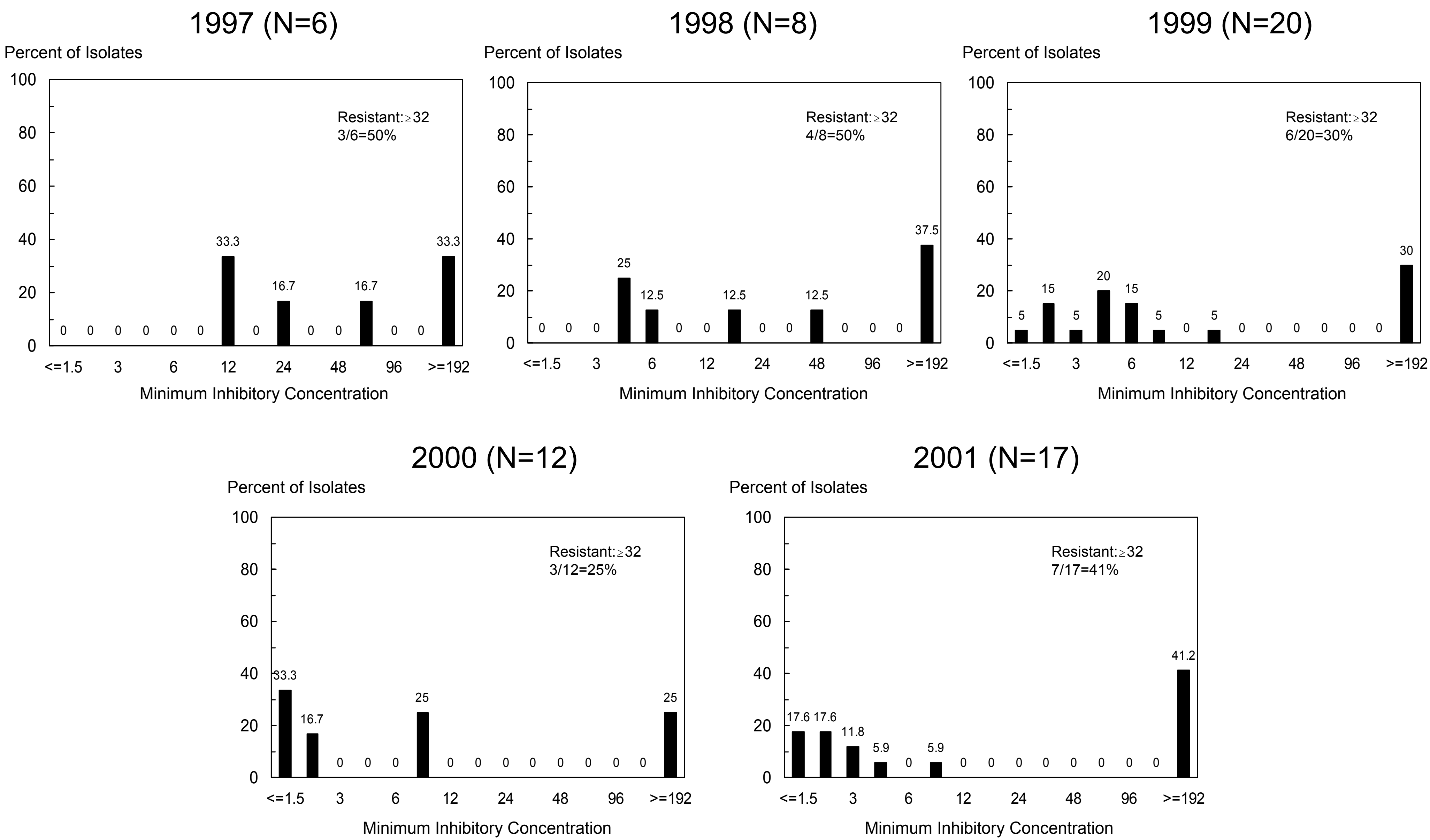

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Figure 22h. MICs for tetracycline among *Campylobacter coli* isolates, 1997-2001