

Section 4

Summary of Antimicrobial Resistance Surveillance

Background

Some scientists consider antibiotics to be the single most impressive medical achievement of the 20th Century. However, the continuing emergence and spread of antimicrobial resistance jeopardizes the utility of antibiotics and threatens public health globally. These pathogens are associated with increased morbidity and mortality, which not only impacts patients but also increases the burden on healthcare services as a result of additional diagnostic testing, prolonged hospital stays, and increased intensity and duration of treatment.

The purpose of antimicrobial resistance surveillance in Florida is to maintain a statewide surveillance and information system that provides data on the incidence and spread of major invasive bacteria with clinically and epidemiologically relevant antimicrobial resistance. Describing the distribution of infection due to resistant organisms within populations, together with changes in patterns of those infections over time, provides the basic information for action both to control disease caused by resistant microorganisms and to contain the emergence of resistance. Strategies to protect the public's health can be developed and evaluated on the basis of this surveillance information.

Currently, *Streptococcus pneumoniae* is one of two diseases on Florida's list of reportable diseases for which drug susceptibilities are required as part of case reporting. Drug-resistant *S. pneumoniae* (DRSP) invasive disease was added to Florida's list of notifiable diseases in mid-1996. Drug-susceptible *S. pneumoniae* (DSSP) invasive disease was added to the list of reportable diseases mid-1999 to permit the assessment of the proportion of pneumococcal isolates that are drug-resistant. These data are currently captured and stored electronically in the Merlin database, though DSSP data weren't captured electronically until 2003. For each case, if there was more than one isolate for antimicrobial susceptibility, isolates were ranked first on date of specimen collection (earliest to latest), invasiveness of the site from which the specimen was collected (most to least), number of antibiotics tested (most to least), and date of report (latest to earliest); only the top ranking isolate was included in this analysis. The rise of antibiotic resistance among isolates of *S. pneumoniae* and the severity of disease it causes highlight the importance of monitoring trends to aid in developing effective treatment and intervention strategies.

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a major cause of both healthcare-associated and community-associated infections. Prior to 2009, the only *S. aureus* reportable condition was isolates showing intermediate or full resistance to vancomycin. Two new *S. aureus* conditions are included on the state's reportable disease list as of the end of 2008; first, community-associated MRSA deaths and second, *S. aureus* isolates from normally sterile sites for those partners participating in electronic laboratory reporting. However, the Florida Department of Health had access to antibiotic susceptibility data starting in 2005 for all *S. aureus* isolates processed by Quest Diagnostics, a commercial laboratory that primarily serves outpatient providers operating throughout Florida. Data for all Quest *S. aureus* isolates from 2003 and 2004 were retrospectively collected and, as of 2009, seven years of data are available. In accordance with National Committee for Clinical Laboratory Standards (NCCLS) guidelines, only the first isolate per person per 365 days was included in this analysis; duplicate isolates were excluded.

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National surveillance has detected *Neisseria meningitidis* isolates with reduced susceptibility to commonly employed antimicrobials. Due to the identification of three fluoroquinolone-resistant *N. meningitidis* isolates in Minnesota and North Dakota in 2007, a regional health advisory was issued, recommending that ciprofloxacin chemoprophylaxis not be used. Rifampin, ceftriaxone, or azithromycin were found to be effective against that strain and were recommended in place of ciprofloxacin. Active testing of *N. meningitidis* isolates obtained between January 2007 and January 2008 in selected sites participating in a CDC-supported surveillance project identified one other fluoroquinolone-resistant isolate, this one from California. The emergence of fluoroquinolone-resistant *Neisseria meningitidis* in the U.S. has raised important questions regarding current chemoprophylaxis guidelines and highlights the expanding threat of antimicrobial resistance in bacterial pathogens. The Centers for Disease Control and Prevention (CDC) responded to this threat by forming MeningNet, an enhanced meningococcal surveillance system that will be used to monitor antimicrobial susceptibility. As part of MeningNet, Florida began forwarding all *N. meningitidis* isolates to the CDC for antibiotic susceptibility testing in late 2008.

Streptococcus pneumoniae

Data Trends

There were a total of 689 cases infected with drug sensitive *S. pneumoniae* and 779 cases infected with drug resistant *S. pneumoniae* in 2009. There were an additional 12 cases who did not have antibiotic susceptibility data reported (because the patient died and further testing was not done); they were reported with the other DSSP cases, but are excluded from this section. Of the 701 DSSP cases, 12 who did not have antibiotic susceptibility data (because the patient died and further testing was not done) are excluded from this section. Additionally, it should be noted that not every antibiotic was tested for every isolate. When calculating percentages for each antibiotic, the denominator is the number of cases with isolates that were tested for that antibiotic. Resistant and intermediate susceptibilities were grouped together as “resistant” for this summary.

With the steady rise of antimicrobial resistance among strains of *S. pneumoniae* in the past decade, it is now more important than ever for physicians to prescribe proper antimicrobial therapy. Where penicillin was previously the drug of choice for all pneumococcal infections, 37.5% of the cases tested in Florida in 2009 were infected with strains resistant to penicillin (see Figure 1 and Table 1). Resistance was most common for clarithromycin, with 48.3% of cases infected with isolates that were tested for this antibiotic showing resistance or intermediate susceptibility. Eight of the antibiotics tracked (azithromycin, cefuroxime axetil, clarithromycin, clindamycin, erythromycin, penicillin, tetracycline, and trimethoprim/sulfamethoxazole) had greater than 25% resistance. Vancomycin, chloramphenicol, and rifampin had the lowest resistance, at 0.5%, 1.3%, and 2.2%, respectively.

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Figure 1. *Streptococcus pneumoniae*, Invasive Disease, Antibiotic Resistance, Florida, 2009

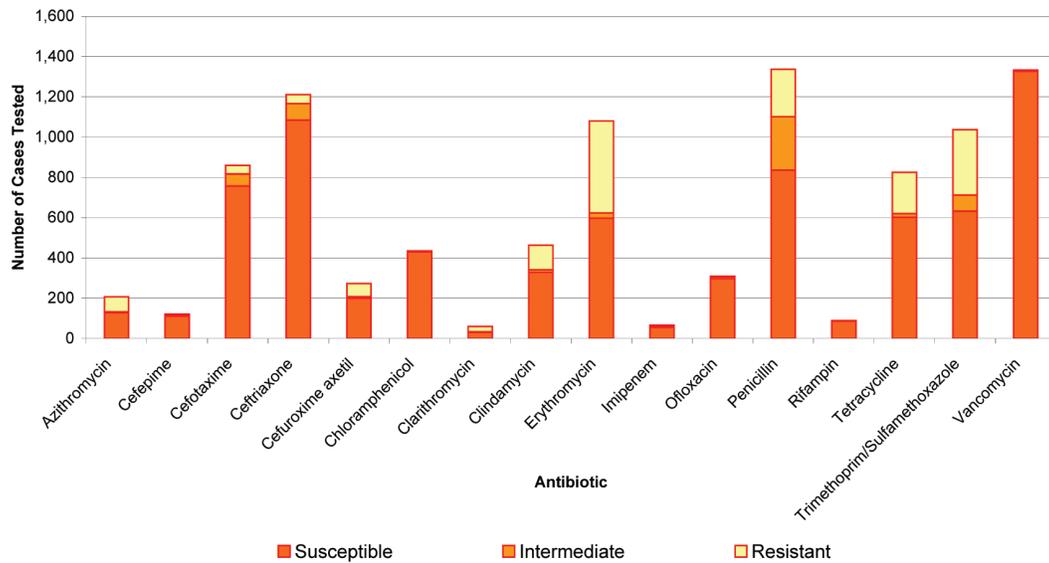


Table 1. *Streptococcus pneumoniae*, Invasive Disease, Antibiotic Resistance, Florida 2009

Antibiotic Name	Number of Isolates Tested [†]	Susceptible	Intermediate	Resistant
Azithromycin	207	61.8%	1.9%	36.2%
Cefepime	121	91.7%	5.8%	2.5%
Cefotaxime	860	88.0%	7.0%	5.0%
Ceftriaxone	1,211	89.5%	6.8%	3.7%
Cefuroxime axetil	273	73.3%	2.6%	24.2%
Chloramphenicol	435	98.9%	0.0%	1.1%
Clarithromycin	60	51.7%	3.3%	45.0%
Clindamycin	463	71.1%	2.6%	26.3%
Erythromycin	1,080	55.3%	2.4%	42.3%
Imipenem	66	83.3%	10.6%	6.1%
Ofloxacin	309	96.1%	3.2%	0.6%
Penicillin	1,337	62.5%	19.8%	17.7%
Rifampin	89	97.8%	0.0%	2.2%
Tetracycline	825	73.0%	2.2%	24.8%
Trimethoprim/sulfamethoxazole	1,037	60.9%	7.7%	31.3%
Vancomycin	1,333	99.5%	0.0%	0.5%

[†]Only one isolate per case was included in this analysis. Please see the methods section for a description of how isolates were selected for inclusion.

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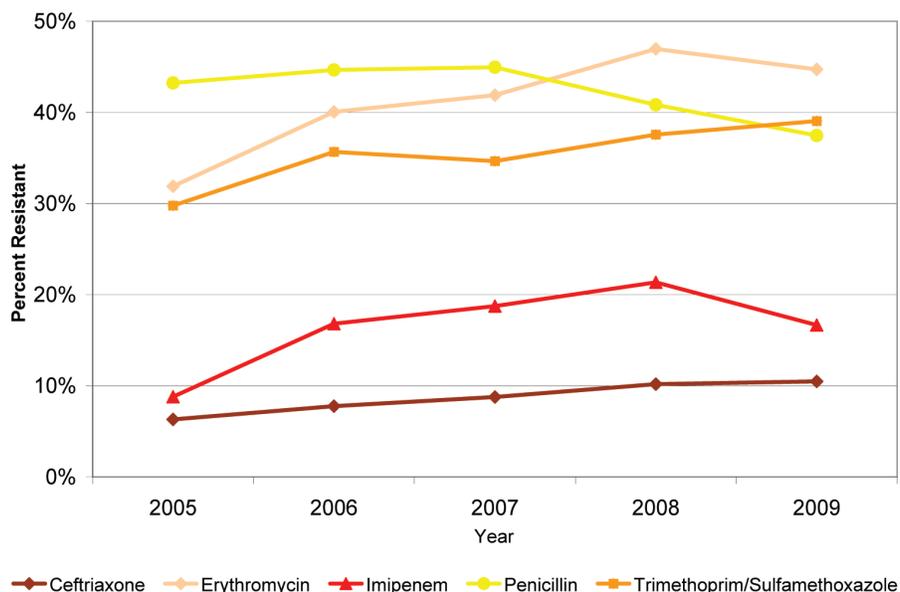
The prevalence of resistance increased for most antibiotics overall from 2005 to 2009, though it decreased for a few antibiotics (Table 2 and Figure 2). Antibiotics with steady increases include ceftriaxone, clindamycin, erythromycin, imipenem, and tetracycline. Resistance to the remaining antibiotics fluctuated over the years. Overall increases were seen for azithromycin, cefotaxime, cefuroxime axetil, clarithromycin, rifampin, and trimethoprim/sulfamethoxazole. Overall decreases were seen for cefepime, chloramphenicol, ofloxacin, and penicillin. Note that ceftriaxone, erythromycin, imipenem, penicillin, and trimethoprim/sulfamethoxazole are highlighted in Table 2 and are presented in Figure 2. These antibiotics were chosen because they represent most of the major antibiotic classes.

Table 2. *Streptococcus pneumoniae*, Invasive Disease, Percentage Resistant to Antibiotics, Florida 2005-2008

Antibiotic Name	2005	2006	2007	2008	2009*
Azithromycin	30.6%	45.4%	44.3%	38.1%	38.2%
Cefepime	9.2%	14.1%	10.2%	6.4%	8.3%
Cefotaxime	8.6%	8.0%	11.3%	11.4%	12.0%
Ceftriaxone	6.2%	7.8%	8.8%	10.3%	10.5%
Cefuroxime axetil	22.1%	29.3%	30.8%	29.7%	26.7%
Chloramphenicol	4.4%	2.8%	4.7%	3.6%	1.1%
Clarithromycin	30.9%	36.9%	51.1%	39.0%	48.3%
Clindamycin	16.2%	20.2%	23.4%	24.9%	28.9%
Erythromycin	31.8%	40.2%	42.0%	47.0%	44.7%
Imipenem	8.6%	15.0%	17.5%	21.2%	16.7%
Ofloxacin	4.4%	5.2%	2.9%	3.7%	3.9%
Penicillin	43.1%	44.7%	44.9%	40.8%	37.5%
Rifampin	0.0%	0.6%	0.0%	0.9%	2.2%
Tetracycline	16.1%	16.6%	21.2%	25.7%	27.0%
Trimethoprim/sulfamethoxazole	29.6%	35.5%	34.4%	37.6%	39.1%
Vancomycin	0.1%	0.8%	0.3%	0.1%	0.5%

* In 2009, a new algorithm was used to select which set of susceptibilities was chosen for inclusion in this report for cases when more than one set of susceptibilities was reported. Caution should be used when comparing 2009 data to data from previous years.

Figure 2. *Streptococcus pneumoniae*, Invasive Disease, Percent Resistant to Select Antibiotics, Florida 2005-2009



In general, the prevalence of resistance to antibiotics is highest in the very young (Table 3). For example, 52.1% of the cases tested for penicillin in those under one year old were infected with resistant organisms, compared to 33.2% in those 25 to 64 years old, and 32.9% in those 65 and older. Overall, the highest rate of resistance was seen against erythromycin; 65.0% of infections in cases one to four years old were resistant while only 44.6% of cases 65 and older were resistant.

Table 3. Percentage of *Streptococcus pneumoniae* Isolates with Full or Intermediate Resistance to Antibiotics by Age, Florida 2009

Age	Number of Isolates Tested†	Azithromycin	Cefepime	Cefotaxime	Ceftriaxone	Cefuroxime axetil	Chloramphenicol	Clarithromycin	Clindamycin	Erythromycin	Imipenem	Ofloxacin	Penicillin	Rifampin	Tetracycline	Trimethoprim/sulfamethoxazole	Vancomycin
<1	56	50.0%	25%*	25.8%	20.0%	54.5%	6.3%	50%*	42.1%	65.0%	75%*	0.0%	52.1%	0.0%	40.0%	60.5%	0.0%
1-4	151	42.9%	25.0%	19.0%	22.0%	43.8%	2.6%	50%*	40.9%	61.5%	0.0%	0.0%	61.7%	0.0%	42.7%	54.4%	0.7%
5-14	63	66.7%	14.3%	13.6%	11.8%	35.0%	0.0%	50%*	31.8%	32.5%	42.9%	0.0%	40.4%	0.0%	34.8%	32.4%	0.0%
15-24	43	60.0%	40.0%	10.7%	14.7%	53.8%	0.0%	-	43.8%	41.9%	0%*	0.0%	52.5%	0%*	34.8%	42.4%	0.0%
25-64	698	35.1%	4.7%	10.9%	8.5%	18.5%	1.0%	43.3%	26.8%	40.9%	13.8%	3.7%	33.2%	2.4%	24.8%	36.4%	0.5%
65+	457	36.1%	3.0%	9.1%	8.2%	21.9%	0.6%	55.0%	24.4%	44.6%	5.6%	6.0%	32.9%	5.0%	23.3%	36.1%	0.5%
Total	1,468	38.2%	8.3%	12.0%	10.5%	26.7%	1.1%	48.3%	28.9%	44.7%	16.7%	3.9%	37.5%	2.2%	27.0%	39.1%	0.5%

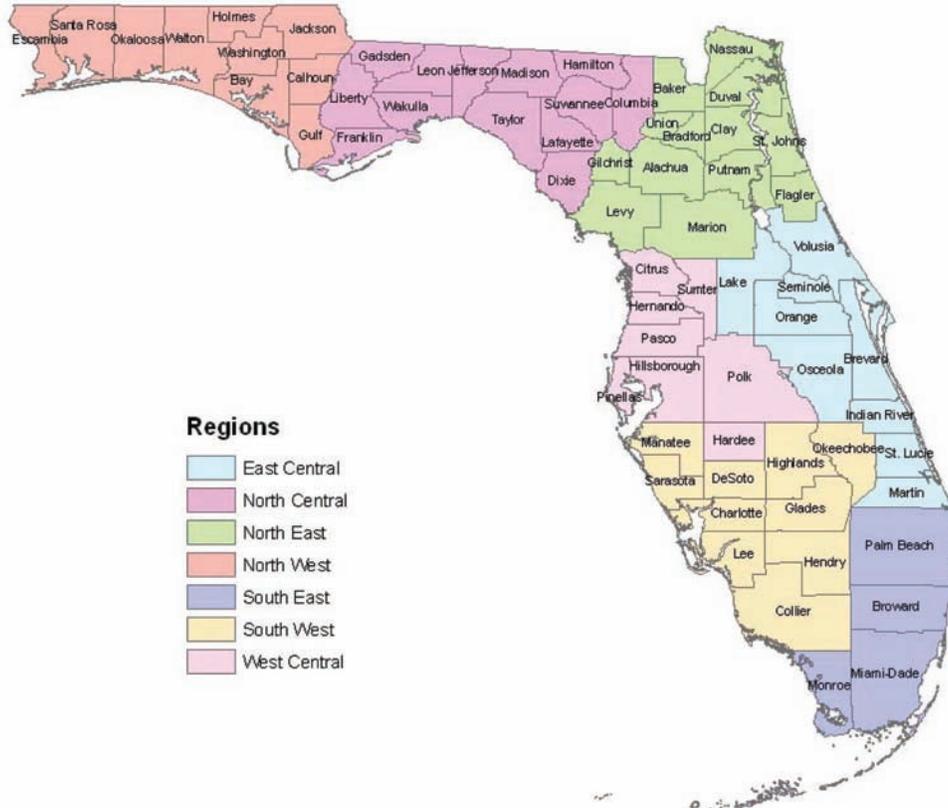
*Marked observations are those in which too few specimens were tested to produce reliable estimates of resistance.

†Only one isolate per case was included in this analysis. Please see the methods section for a description of how isolates were selected for inclusion.

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Resistance patterns were also summarized by region and county. The Regional Domestic Security Task Force regions were used, as depicted in Figure 3.

Figure 3. Regional Domestic Security Task Force Regions



The East Central Region of Florida had 259 (17.6%) of the 1,468 cases included in this summary (Figure 4 and Table 4). Isolates from these cases had the highest resistance percentages to azithromycin (47.8%), trimethoprim/sulfamethoxazole (42.5%), and erythromycin (42.1%). Azithromycin, cefuroxime axetil, clindamycin, erythromycin, penicillin, tetracycline, and trimethoprim/sulfamethoxazole all had resistance percentages greater than 25.0%.

The North Central Region of Florida had 56 (3.8%) of the 1,468 cases included in this summary (Figure 5 and Table 4). There were less than five cases tested for clarithromycin, imipenem, and rifampin resistance. The small denominators for these antibiotics make the resistance percentages uninterpretable and they are excluded from this report. Of the remaining antibiotics, the highest percentage of resistance was seen in azithromycin (50.0%), followed by erythromycin (37.5%). Azithromycin, erythromycin, penicillin, tetracycline, and trimethoprim/sulfamethoxazole all had resistance percentages greater than 25.0%.

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The North East Region of Florida had 196 (13.4%) of the 1,468 cases included in this summary (Figure 6 and Table 4). Less than five cases had isolates tested for clarithromycin, imipenem, and rifampin, making the resistance percentages for these antibiotics uninterpretable and they are excluded from this report. Of the remaining antibiotics, erythromycin and penicillin had the highest resistance rates (38.3% for both) followed by trimethoprim/sulfamethoxazole (34.6%) and azithromycin (30.0%). The remaining antibiotics had resistance percentages that were less than 25.0%.

The North West Region of Florida had 95 (6.5%) of the 1,468 cases included in this summary (Figure 7 and Table 4). Less than five cases had isolates tested for rifampin resistance, making the resistance percentage for this antibiotic uninterpretable due to the small denominator, and it was excluded from this report. Clarithromycin had the greatest resistance rate (40.0%), followed by penicillin (36.5%), erythromycin (35.7%), trimethoprim/sulfamethoxazole (35.4%), and azithromycin (33.3%) .

The South East Region of Florida had 395 (26.9%) of the 1,468 cases included in this summary (Figure 8 and Table 4). Isolates from these cases had the greatest resistance to clarythromycin (56.5%); 23 cases had clarithromycin susceptibility results. Erythromycin and azithromycin had the next highest resistance percentages (50.1% and 50.0%, respectively). Azithromycin, cefuroxime axetil, clarithromycin, clindamycin, erythromycin, imipenem, penicillin, tetracycline, and trimethoprim/sulfamethoxazole all had resistance rates greater than 25.0%.

The South West Region of Florida had 165 (11.2%) of the 1,468 cases included in this summary (Figure 9 and Table 4). Fewer than five cases had isolates tested with susceptibility results for cefepime, imipenem, and rifampin, and antibiotic resistance information for these two drugs was excluded from this report because it was uninterpretable. Of the remaining antibiotics, the highest resistance percentages were seen in clarithromycin (80.0%), erythromycin (51.6%), and trimethorprim/sulfamethoxazole (42.8%). Azithromycin and penicillin also had resistance percentages greater than 25.0%.

The West Central Region of Florida had 302 (20.6%) of the 1,468 cases included in this summary (Figure 10 and Table 4). Isolates from these cases had the greatest resistance to azithromycin and erythromycin (44.4% and 44.1%, respectively). Cefuroxime axetil, clarithromycin, clindamycin, penicillin, tetracycline, and trimethoprim/sulfamethoxazole also had resistance percentages greater than 25.0%.

Resistance rates by county are presented in Table 5.

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Figure 4. *Streptococcus pneumoniae*, Invasive Disease, Antibiotic Resistance, East Central Region, Florida 2009

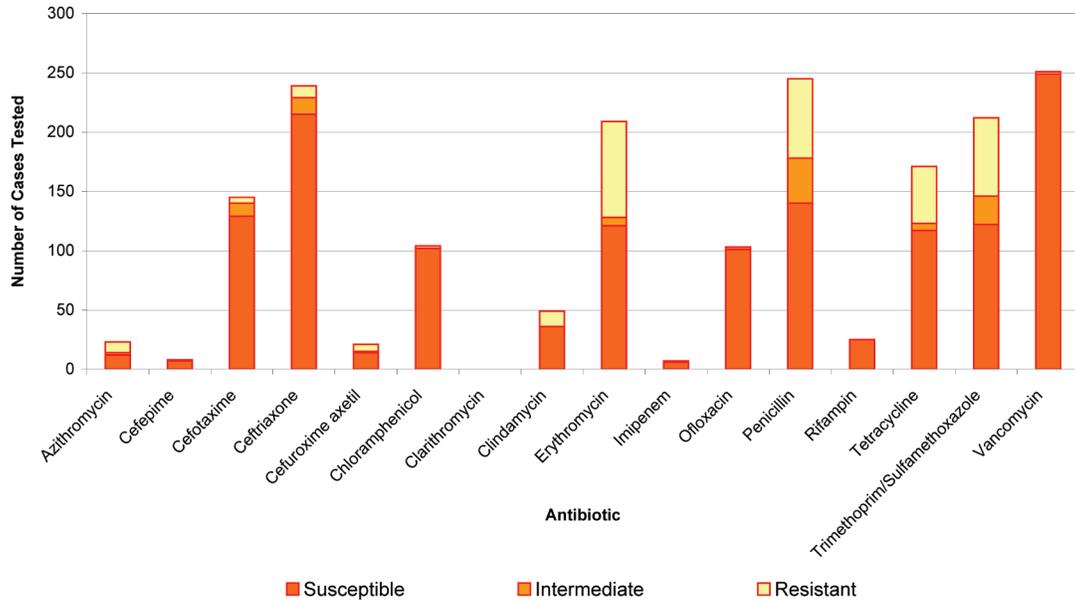
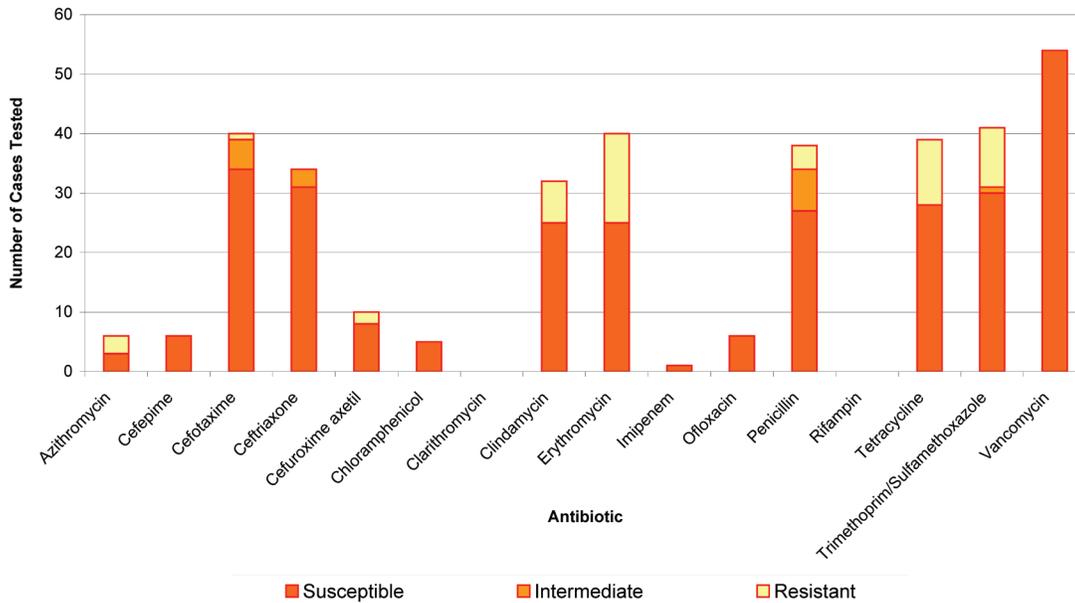


Figure 5. *Streptococcus pneumoniae*, Invasive Disease, Antibiotic Resistance, North Central Region, Florida 2009



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Figure 6. *Streptococcus pneumoniae*, Invasive Disease, Antibiotic Resistance, North East Region, Florida 2009

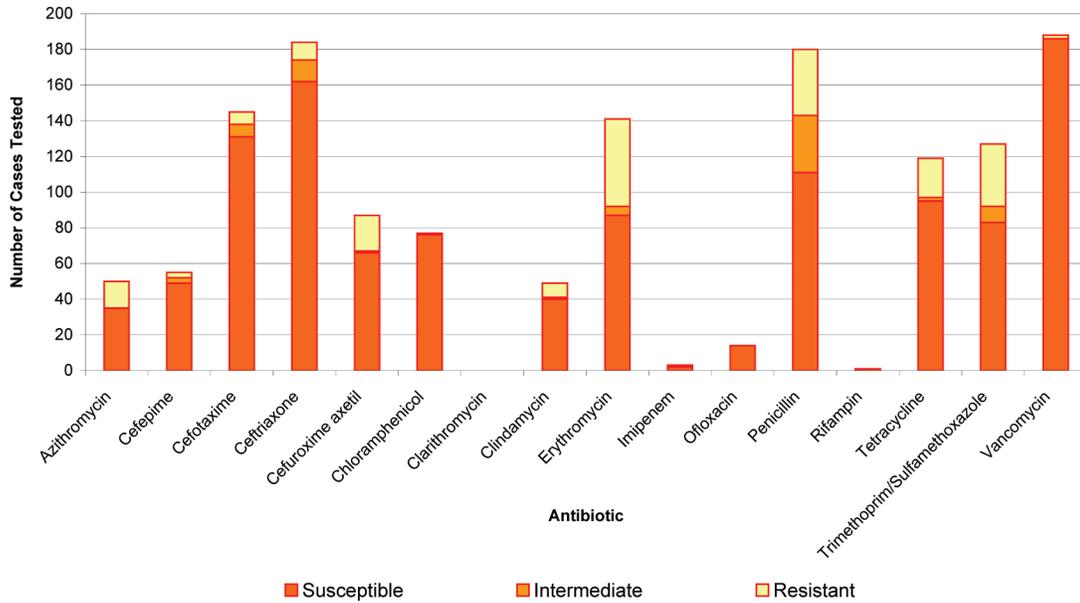
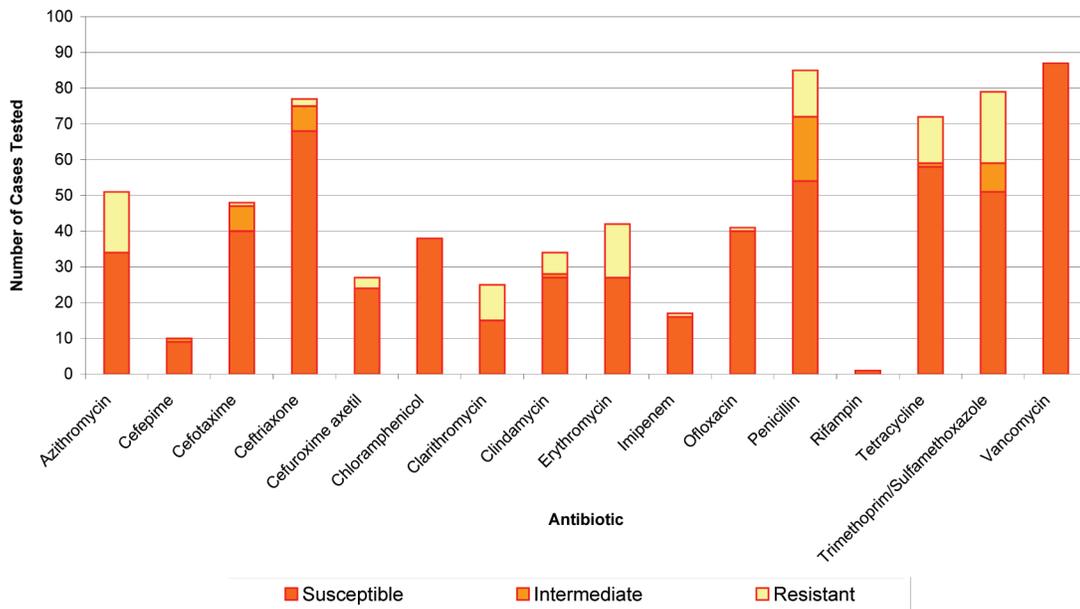


Figure 7. *Streptococcus pneumoniae*, Invasive Disease, Antibiotic Resistance, North West Region, Florida 2009



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Figure 8. *Streptococcus pneumoniae*, Invasive Disease, Antibiotic Resistance, South East Region, Florida 2009

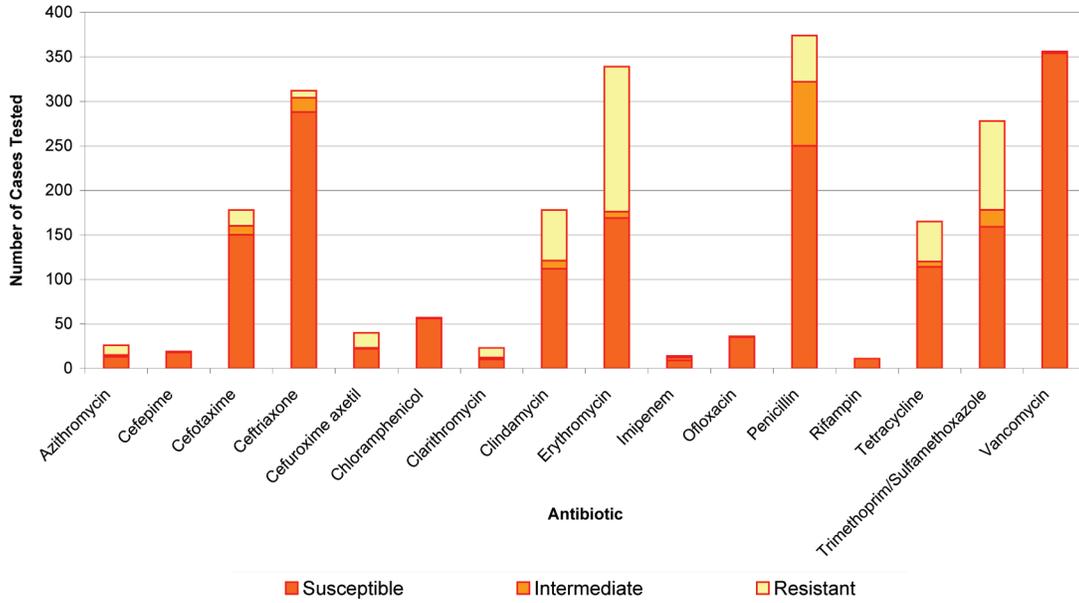
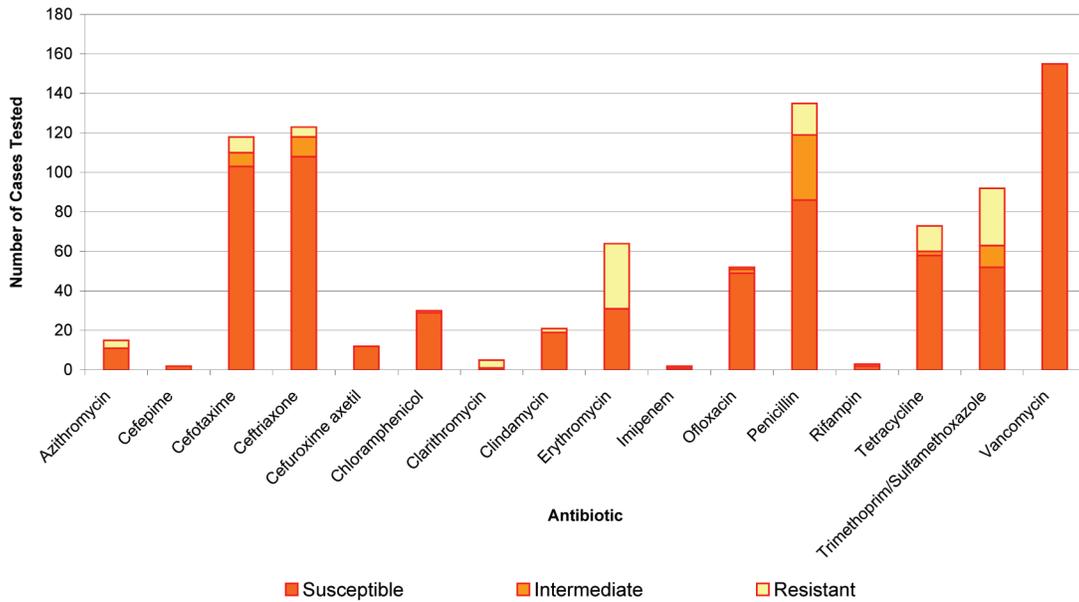


Figure 9. *Streptococcus pneumoniae*, Invasive Disease, Antibiotic Resistance, South West Region, Florida 2009



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Figure 10. *Streptococcus pneumoniae*, Invasive Disease, Antibiotic Resistance, West Central Region, Florida 2009

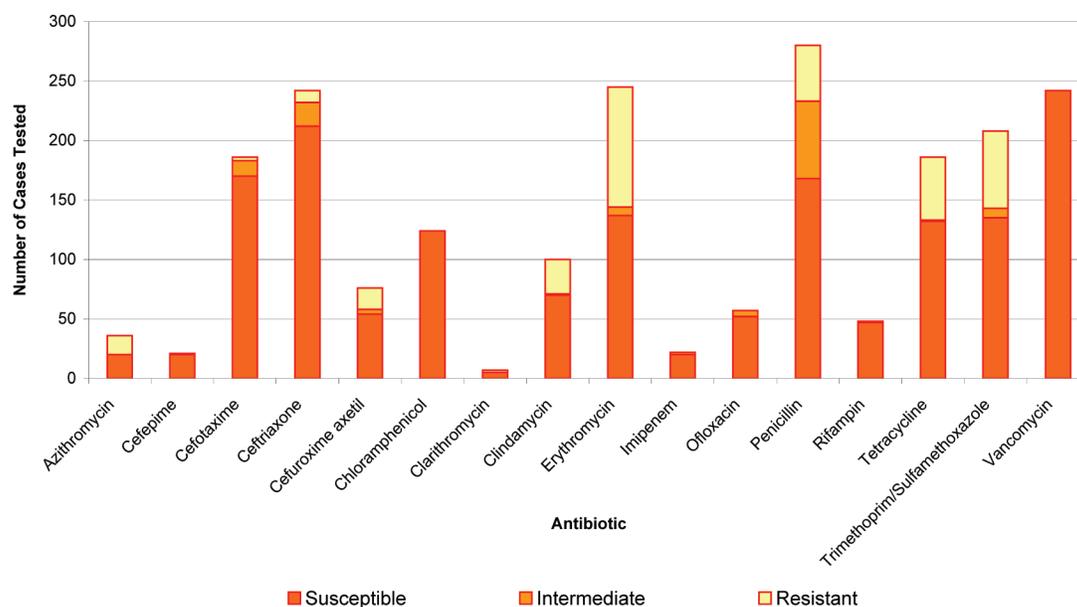


Table 4. *Streptococcus pneumoniae*, Invasive Disease, Percentage Resistant to Antibiotics by Region, Florida 2009

Region	Number of Isolates Tested†	Azithromycin	Cefepime	Cefotaxime	Ceftriaxone	Cefuroxime axetil	Chloramphenicol	Clarithromycin	Clindamycin	Erythromycin	Imipenem	Ofloxacin	Penicillin	Rifampin	Tetracycline	Trimethoprim/sulfamethoxazole	Vancomycin
East Central	259	47.8%	12.5%	11.0%	10.0%	33.3%	1.9%	-	26.5%	42.1%	14.3%	1.9%	42.9%	0.0%	31.6%	42.5%	0.8%
North Central	56	50.0%	0.0%	15.0%	8.8%	20.0%	0.0%	-	21.9%	37.5%	0%	0.0%	28.9%	-	28.2%	26.8%	0.0%
North East	196	30.0%	10.9%	9.7%	12.0%	24.1%	1.3%	-	18.4%	38.3%	33.3%	0.0%	38.3%	0%	20.2%	34.6%	1.1%
North West	95	33.3%	10.0%	16.7%	11.7%	11.1%	0.0%	40.0%	20.6%	35.7%	5.9%	2.4%	36.5%	0%	19.4%	35.4%	0.0%
South East	395	50.0%	5.3%	15.7%	7.7%	45.0%	1.8%	56.5%	37.1%	50.1%	35.7%	2.8%	33.2%	0.0%	30.9%	42.8%	0.6%
South West	165	26.7%	0%	12.7%	12.2%	0.0%	3.3%	80.0%	9.5%	51.6%	50%	5.8%	36.3%	33.3%	20.5%	43.5%	0.0%
West Central	302	44.4%	4.8%	8.6%	12.4%	28.9%	0.0%	28.6%	30.0%	44.1%	9.1%	8.8%	40.0%	2.1%	29.0%	35.1%	0.0%
Total	1,468	38.2%	8.3%	12.0%	10.5%	26.7%	1.1%	48.3%	28.9%	44.7%	16.7%	3.9%	37.5%	2.2%	27.0%	39.1%	0.5%

†Marked observations are those in which too few specimens were tested to produce reliable estimates of resistance.

‡Only one isolate per case was included in this analysis. Please see the methods section for a description of how isolates were selected for inclusion.

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Table 5. *Streptococcus pneumoniae*, Invasive Disease, Percentage Resistant to Antibiotics by County, Florida 2009

County	Number of Isolates Tested†	Azithromycin	Cefepime	Cefotaxime	Ceftazoxime	Cefuroxime axetil	Chloramphenicol	Clarithromycin	Clindamycin	Erythromycin	Imipenem	Ofloxacin	Penicillin	Rifampin	Tetracycline	Trimethoprim/sulfamethoxazole	Vancomycin
Alachua	29	33.3%	13.3%	12.5%	13.8%	18.5%	0.0%	-	-	28.6%	-	-	28.6%	-	26.7%	35.7%	0.0%
Baker	4	0%	50%	33.3%	33.3%	25%	0%	-	25%	25%	-	-	33.3%	-	0%	0%	0%
Bay	19	-	-	0%	0.0%	14.3%	0.0%	-	-	100%	-	0.0%	29.4%	-	12.5%	44.4%	0.0%
Brevard	50	27.3%	-	14.3%	6.5%	0.0%	10.0%	-	0%	32.4%	0.0%	0%	38.0%	-	20.0%	38.5%	0.0%
Broward	126	100%	-	9.1%	5.8%	-	0%	50%	32.2%	54.1%	-	0.0%	29.8%	-	33.3%	43.0%	0.8%
Calhoun	1	100%	0%	100%	100%	100%	-	-	0%	100%	-	-	100%	-	0%	0%	0%
Charlotte	6	-	-	0%	0%	-	0.0%	-	-	20.0%	-	0.0%	50%	-	16.7%	50.0%	0.0%
Citrus	17	-	0.0%	9.1%	7.1%	30.8%	-	-	23.1%	35.7%	0%	0.0%	33.3%	-	18.2%	18.2%	0.0%
Clay	18	-	-	0.0%	16.7%	50%	-	-	0%	83.3%	-	0%	56.3%	-	25%	80.0%	0.0%
Collier	26	-	-	0.0%	0.0%	0.0%	-	-	-	53.3%	-	0.0%	34.6%	-	13.0%	43.5%	0.0%
Columbia	14	0%	0%	0%	0.0%	0%	0%	-	-	0%	-	-	23.1%	-	0%	0%	0.0%
Dade	191	37.5%	0%	22.8%	10.4%	57.1%	2.9%	50.0%	45.8%	43.8%	45.5%	11.1%	31.6%	0.0%	24.2%	43.5%	0.6%
DeSoto	2	-	-	0%	-	-	-	-	-	-	-	0%	100%	-	-	0%	0%
Dixie	3	100%	0%	66.7%	66.7%	100%	0%	-	-	66.7%	-	-	66.7%	-	66.7%	100%	0%
Duval	87	26.3%	4.8%	5.4%	8.8%	14.3%	3.4%	-	15.6%	36.4%	-	0.0%	35.9%	-	18.2%	30.6%	0.0%
Escambia	50	37.1%	0%	16.7%	10.4%	0.0%	0.0%	52.6%	19.0%	40.9%	0.0%	5.6%	40.9%	-	22.0%	41.0%	0.0%
Flagler	4	-	-	0%	0%	100%	-	-	-	100%	-	-	100%	-	66.7%	66.7%	0%
Franklin	1	-	0%	0%	0%	0%	-	-	0%	0%	-	-	0%	-	0%	0%	0%
Gadsden	5	-	-	0%	0.0%	0%	-	-	0%	0%	-	0%	0%	-	0%	25%	0%
Gilchrist	2	50%	0%	0%	0%	0%	0%	-	-	100%	-	0%	0%	-	0%	0%	0%
Glades	1	-	-	0%	0%	-	-	-	-	-	-	-	0%	-	-	-	0%
Hamilton	1	-	-	-	0%	-	-	-	-	-	-	-	0%	-	-	-	0%

†Marked observations are those in which too few specimens were tested to produce reliable estimates of resistance.
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Table 5. (Continued) *Streptococcus pneumoniae*, Invasive Disease, Percentage Resistant to Antibiotics by County, Florida 2009

County	Number of Isolates Tested [†]	Azithromycin	Cefepime	Cefotaxime	Ceftriaxone	Cefuroxime axetil	Chloramphenicol	Clarithromycin	Clindamycin	Erythromycin	Impipenem	Ofloxacin	Penicillin	Ritampin	Tetracycline	Trimethoprim/sulfamethoxazole	Vancomycin
Hardee	3	0%	-	0%	0%	-	0%	0%	-	100%	0%	0%	-	-	33.3%	33.3%	0%
Hendry	6	-	-	60.0%	60.0%	0%	0%	-	-	100%	-	50%	60.0%	-	40.0%	60.0%	0.0%
Hernando	30	50.0%	0%	0%	25.0%	33.3%	0%	-	35.7%	50.0%	0%	-	40.0%	-	42.9%	35.7%	0.0%
Highlands	12	80.0%	-	0.0%	10.0%	-	0.0%	80.0%	-	87.5%	0%	10.0%	100%	-	22.2%	60.0%	0.0%
Hillsborough	89	-	-	9.7%	7.5%	22.2%	0.0%	-	24.4%	47.1%	11.8%	18.5%	43.0%	2.9%	27.8%	38.7%	0.0%
Holmes	3	0%	-	-	0%	0%	-	0%	0%	0%	-	-	0%	-	0%	0%	0%
Indian River	9	-	-	-	14.3%	-	-	-	0.0%	44.4%	-	0%	55.6%	-	-	-	22.2%
Jackson	4	33.3%	33.3%	25%	33.3%	33.3%	-	0%	25%	25%	33.3%	0%	50%	-	25%	25%	0%
Jefferson	2	-	-	0%	0%	-	-	-	0%	50%	-	-	0%	-	100%	50%	0%
Lake	31	100%	0%	12.5%	17.2%	50%	4.8%	-	50%	38.9%	100%	0.0%	38.5%	-	30.8%	40.0%	0.0%
Lee	53	0%	-	25.0%	19.6%	0%	-	-	-	33.3%	-	20.0%	31.3%	-	14.3%	12.5%	0.0%
Leon	27	0%	-	15.4%	20.0%	-	-	-	26.1%	40.0%	0%	0%	42.9%	-	24.0%	23.1%	0.0%
Levy	6	50%	0%	50%	0.0%	66.7%	0%	-	-	50%	50%	0%	66.7%	-	50%	50%	20.0%
Manatee	24	0%	0%	11.8%	8.3%	0%	9.1%	-	18.2%	52.9%	100%	0.0%	45.0%	0%	41.7%	63.6%	0.0%
Marion	31	27.3%	15.4%	13.3%	16.7%	26.7%	0.0%	-	25.0%	28.0%	-	-	32.3%	-	13.8%	32.1%	3.3%
Martin	6	-	100%	100%	33.3%	40.0%	-	-	-	50.0%	-	-	33.3%	-	100%	-	0%
Monroe	5	-	-	0%	0.0%	-	-	-	0%	33.3%	-	0%	25%	-	0.0%	0.0%	0%
Nassau	9	-	-	25.0%	25.0%	-	0%	-	-	42.9%	-	0%	55.6%	-	28.6%	28.6%	0.0%
Okaloosa	5	50%	0%	20.0%	25%	0%	0%	0%	50%	20.0%	0%	0%	40.0%	-	20.0%	50%	0%
Okeechobee	2	-	-	-	0%	-	-	-	-	0%	-	-	-	-	-	-	0%
Orange	80	33.3%	0%	9.1%	2.6%	0%	0.0%	-	0%	41.9%	-	3.0%	41.3%	-	30.6%	47.4%	0.0%
Osceola	11	100%	0%	11.1%	10.0%	0%	0%	-	-	33.3%	0%	25%	54.5%	-	28.6%	50.0%	0.0%

[†]Marked observations are those in which too few specimens were tested to produce reliable estimates of resistance.
[‡]Only one isolate per case was included in this analysis. Please see the methods section for a description of how isolates were selected for inclusion.

Section 4: Summary of Antimicrobial Resistance Surveillance

Table 5. (Continued) *Streptococcus pneumoniae*, Invasive Disease, Percentage Resistant to Antibiotics by County, Florida 2009

County	Number of Isolates Tested [†]	Azithromycin	Cefepime	Cefotaxime	Ceftriaxone	Cefuroxime axetil	Chloramphenicol	Clarithromycin	Clindamycin	Erythromycin	Impipenem	Ofloxacin	Penicillin	Ritampin	Tetracycline	Trimethoprim/sulfamethoxazole	Vancomycin
Palm Beach	73	52.9%	6.3%	7.9%	6.5%	38.5%	0.0%	60.0%	27.8%	61.1%	0%	0.0%	43.1%	-	40.9%	45.7%	0.0%
Pasco	26	28.6%	0.0%	0.0%	10.0%	37.5%	0.0%	50%	28.6%	45.0%	-	0.0%	47.4%	0.0%	33.3%	29.4%	0.0%
Pinellas	62	-	100%	9.4%	12.2%	20.0%	0.0%	0%	41.2%	38.6%	-	0%	41.4%	0.0%	19.4%	31.8%	0.0%
Polk	68	50%	0%	9.1%	14.5%	-	0.0%	33.3%	33.3%	43.5%	0%	0.0%	34.8%	0%	35.7%	43.5%	0.0%
Putnam	3	-	-	-	0%	-	-	-	-	-	0%	0%	33.3%	0%	-	-	0%
Santa Rosa	11	12.5%	0%	0.0%	10.0%	0%	0%	0%	20.0%	20.0%	0%	0%	18.2%	0%	20.0%	10.0%	0.0%
Sarasota	33	0.0%	0%	0.0%	0.0%	0%	0%	-	0.0%	36.4%	-	0%	30.0%	100%	9.1%	35.7%	0.0%
Seminole	12	50%	0%	0.0%	8.3%	50%	0.0%	-	50%	50.0%	-	0.0%	50.0%	-	33.3%	33.3%	0.0%
St. Johns	3	-	-	0%	0%	-	-	-	-	66.7%	-	-	66.7%	-	0%	66.7%	0%
St. Lucie	16	-	0%	0%	7.1%	50%	0%	-	25%	50.0%	-	0.0%	56.3%	-	50%	66.7%	0.0%
Sumter	7	-	0%	14.3%	14.3%	-	0.0%	-	100%	33.3%	-	0%	33.3%	-	28.6%	28.6%	0.0%
Taylor	1	100%	0%	0%	0%	0%	0%	-	-	100%	-	0%	0%	-	100%	0%	0%
Volusia	44	0%	0%	25.0%	21.6%	100%	0.0%	-	34.5%	50.0%	-	0.0%	42.9%	0.0%	34.1%	38.1%	0.0%
Wakulla	2	-	-	0%	0%	-	-	-	50%	50%	-	0%	-	-	50%	50%	0%
Walton	2	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	50%	-	0%	0%	0%
Washington	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,468	38.2%	8.3%	12.0%	10.5%	26.7%	1.1%	48.3%	28.9%	44.7%	16.7%	3.9%	37.5%	2.2%	27.0%	39.1%	0.5%

[†]Marked observations are those in which too few specimens were tested to produce reliable estimates of resistance.
[‡]Only one isolate per case was included in this analysis. Please see the methods section for a description of how isolates were selected for inclusion.

Staphylococcus aureus

Data Trends

Physicians must rely on local epidemiological data to inform empiric treatment decisions when patients present with infections that they suspect are caused by *S. aureus*. The Florida Department of Health had access to antibiotic susceptibility data starting in 2005 for all *S. aureus* isolates processed by Quest Diagnostics, a commercial laboratory that primarily serves outpatient providers operating throughout Florida. Data for all Quest *S. aureus* isolates from 2003 and 2004 were retrospectively collected and, as of 2009, seven years of data are available. In accordance with National Committee for Clinical Laboratory Standards (NCCLS) guidelines, only the first isolate per person per 365 days was included in this analysis; duplicate isolates were excluded from this analysis.

After the removal of duplicate isolates there were 50,996 isolates included in this analysis that were collected in 2006, 53,424 in 2007, 62,068 in 2008, and 64,924 in 2009. The percentage of all isolates that had methicillin-resistance was just above 50% for the entire period. Methicillin-resistant *S. aureus* is resistant to all β -lactam antibiotics, including penicillins, carbapenems, and cephalosporins. For moderately severe infections, when the rate of MRSA in the community is substantial, American Academy of Pediatrics treatment recommendations are to treat with clindamycin, doxycycline, or trimethoprim-sulfamethoxazole, unless the rate of clindamycin resistance is also substantial, in which case recommended treatment for *S. aureus* is vancomycin plus gentamicin or rifampin. Eighteen point five percent of all *S. aureus* isolates tested in 2009 were resistant to clindamycin. The commercial laboratory that supplied the data does not regularly test for resistance to doxycycline. Resistance against trimethoprim-sulfamethoxazole remained low with only 2.1% of cases being resistant. Other drugs against which there were high levels of resistance were: erythromycin (64.7%); amoxicillin-clavulanic acid (50.3%); cefazolin (50.4%); ciprofloxacin (28.5%); and levofloxacin (27.4%).

The commercial laboratory, Quest, that supplied the data for this analysis used the Vitek system to determine resistance patterns, a test method that has been noted for the occurrence of false-positive test results for vancomycin resistance. It is protocol that isolates that are initially non-susceptible to vancomycin should be retested using manual methods, but, unfortunately, final results of that testing are not always included in the data. While there are several vancomycin non-susceptible isolates included in this data, to date, there have been no vancomycin-resistant *S. aureus* (VRSA) infections reported to FDOH and only 10 laboratory-confirmed vancomycin-intermediate *S. aureus* (VISA) infections reported. There was one VISA case reported in 2007, three in 2008, and six in 2009. The case definition for VISA was changed during that period, lowering the MIC from ≥ 8 $\mu\text{g/ml}$ to 4-8 $\mu\text{g/ml}$. The increase in reported VISA from 2007 to 2009 is thus partly attributable to a reporting artifact and not reflective of the true magnitude of any increase in VISA that may have occurred.

Section 4: Summary of Antimicrobial Resistance Surveillance

Figure 11. *Staphylococcus aureus*, Antibiotic Resistance, Florida 2009

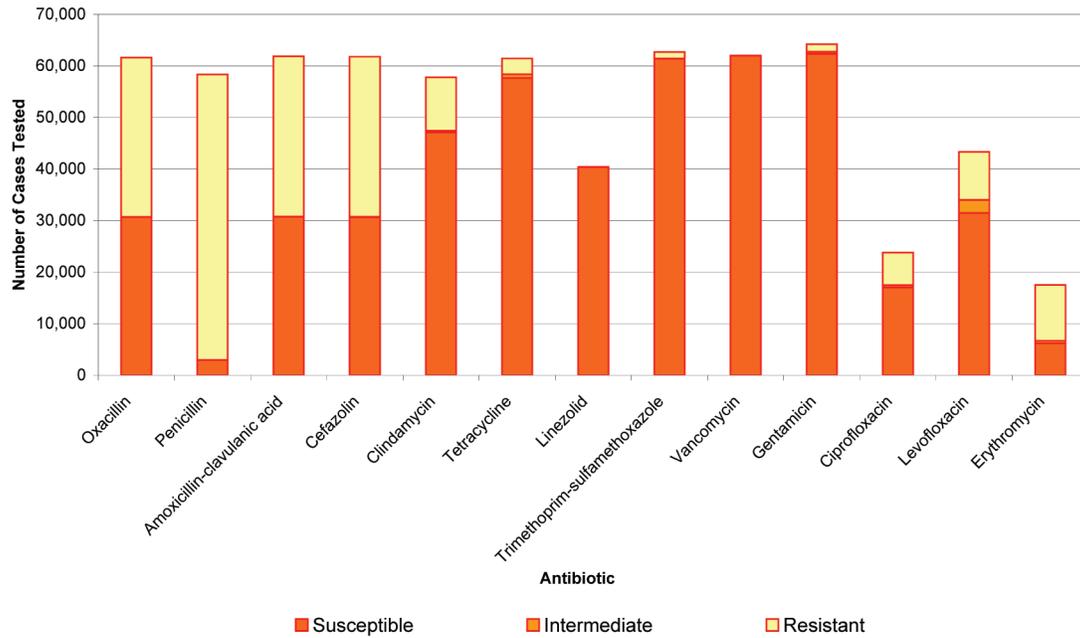


Table 6. *Staphylococcus aureus*, Antibiotic Resistance, Florida 2009

Antibiotic Name	Number of Isolates Tested	Susceptible	Intermediate	Resistant
Oxacillin ¹	61,626	49.8%	0.0%	50.2%
Penicillin	58,343	5.1%	0.0%	94.9%
Amoxicillin-clavulanic acid	61,869	49.7%	0.0%	50.3%
Cefazolin	61,786	49.6%	0.1%	50.3%
Clindamycin	57,780	81.5%	0.6%	17.9%
Tetracycline	61,439	93.8%	1.2%	5.0%
Linezolid	40,403	100%	0.0%	0.0%
Trimethoprim-sulfamethoxazole	62,701	97.9%	0.0%	2.1%
Vancomycin	62,008	99.9% ²	0.0%	0.0%
Gentamicin	64,219	97.1%	0.6%	2.3%
Ciprofloxacin	23,787	71.6%	1.9%	26.6%
Levofloxacin	43,343	72.6%	5.8%	21.6%
Erythromycin	17,527	35.3%	2.8%	61.9%

¹Oxacillin resistance is a marker for MRSA.

²Vancomycin non-susceptible cases are likely false-positives. There were only 6 laboratory-confirmed vancomycin-intermediate *S. aureus* cases reported to the FDOH in 2009.

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The prevalence of resistance stayed relatively constant from 2006 to 2009 (Table 7). Antibiotics with slight increases include penicillin, clindamycin, trimethoprim-sulfamethoxazole, gentamicin, ciprofloxacin, and levofloxacin. Slight decreases in resistance were seen for cefazolin and erythromycin. Oxacillin is highlighted in Table 2 because oxacillin resistance is used as the marker for methicillin resistance in determining whether to classify an *S. aureus* organism as MRSA or methicillin-susceptible (MSSA).

Table 7. Percentage of *Staphylococcus aureus* Isolates with Intermediate or Higher Level Resistance to Antibiotics, Florida 2006-2009

Antibiotic Name	2006	2007	2008	2009
Oxacillin*	50.1%	52.0%	51.9%	50.2%
Penicillin	91.3%	91.7%	92.9%	94.9%
Amoxicillin-clavulanic acid	50.3%	52.3%	51.9%	50.3%
Cefazolin	56.1%	52.2%	52.0%	50.4%
Clindamycin	15.7%	18.9%	17.9%	18.5%
Tetracycline	6.2%	5.6%	5.6%	6.2%
Linezolid	0.2%	0.1%	0.0%	0.0%
Trimethoprim-sulfamethoxazole	1.2%	1.3%	1.8%	2.1%
Vancomycin	0.0%	0.0%	0.0%	0.1% [†]
Gentamicin	1.7%	1.8%	1.9%	2.9%
Ciprofloxacin	25.5%	27.6%	28.4%	28.4%
Levofloxacin	23.9%	25.6%	24.3%	27.4%
Erythromycin	66.4%	65.9%	66.8%	64.7%

*Oxacillin resistance is a marker for MRSA.

[†]Vancomycin non-susceptible cases are likely false-positives. There were only 6 laboratory-confirmed vancomycin-intermediate *S. aureus* cases reported to the FDOH in 2009.

In general, the prevalence of resistance to antibiotics is highest among young children aged one to four years, and among adults aged 25 years and older. Resistance to fluoroquinolones showed the greatest variation in resistance levels, with only 18.2% and 17.0% of isolates in children aged five to fourteen years resistant to ciprofloxacin and levofloxacin, respectively. While among persons aged 65 years and older, 44.9% and 39.9% of isolates, respectively, were resistant (Table 8).

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Table 8. Percentage of *Staphylococcus aureus* Isolates with Full or Intermediate Resistance to Antibiotics by Age, Florida 2009

Age (years)	Number of Isolates Tested	Oxacillin [*]	Penicillin	Amoxicillin-clavulanic acid	Cefazolin	Clindamycin	Tetracycline	Linezolid	Trimethoprim-sulfamethoxazole	Vancomycin	Gentamicin	Ciprofloxacin	Levofloxacin	Erythromycin
<1	1,310	50.1%	95.1%	49.8%	50.4%	16.2%	4.8%	0.0%	1.4%	0.1% [†]	1.9%	17.9%	19.2%	63.4%
1-4	5,389	61.6%	97.6%	61.5%	61.8%	11.3%	4.3%	0.0%	1.4%	0.1% [†]	2.1%	21.2%	24.7%	70.8%
5-14	7,753	44.9%	96.5%	45.0%	45.1%	16.9%	4.5%	0.0%	1.0%	0.1% [†]	1.4%	18.2%	17.0%	57.2%
15-24	7,944	46.8%	94.7%	46.9%	46.9%	14.9%	6.3%	0.1%	1.0%	0.0%	1.6%	18.7%	19.7%	61.1%
25-64	28,784	50.5%	94.8%	50.7%	50.7%	16.2%	6.4%	0.0%	2.0%	0.0%	2.5%	26.5%	28.0%	65.5%
65+	13,156	49.9%	93.1%	50.0%	50.1%	31.6%	7.4%	0.0%	3.8%	0.0%	6.1%	44.9%	39.9%	68.4%
Total	64,924 [§]	50.2%	94.9%	50.3%	50.4%	18.5%	6.2%	0.0%	2.1%	0.1% [†]	2.9%	28.5%	27.4%	64.7%

^{*}Oxacillin resistance is a marker for MRSA.

[§]Column does not sum to zero due to missing age values.

[†]Vancomycin non-susceptible cases are likely false-positives. There were only 6 laboratory-confirmed vancomycin-intermediate *S. aureus* cases reported to the FDOH in 2009.

Resistance patterns were also summarized by region and county. The Regional Domestic Security Task Force regions were used, as depicted in Figure 3. Of the 64,924 *S. aureus* isolates tested in 2009, 6,514 were from patients who were not Florida residents, and 3,977 were from patients who were Florida residents, but whose county of residence not available. This left 54,433 isolates that were from Florida residents whose county of residence was known.

Of the 54,433 *S. aureus* isolates from Florida residents tested in 2009 whose county of residence was known, 9,729 (17.9%) were from patients residing in the East Central Region of Florida (Figure 12 and Table 9). The resistance patterns seen were similar to those seen in the state as a whole. More than 25% of isolates were resistant to oxacillin, penicillin, amoxicillin-clavulanic acid, cefazolin, ciprofloxacin, levofloxacin, and erythromycin.

Of the 54,433 *S. aureus* cases from Florida residents tested in 2009 whose county of residence was known, 1,296 (2.4%) were from patients residing in the North Central Region of Florida (Figure 13 and Table 9). A higher proportion of isolates from the North Central Region was MRSA (57.2%) compared with the statewide average (50.7%). There were also a higher than average proportion of cases resistant to amoxicillin-clavulanic acid (57.4%), cefazolin (57.3%), and ciprofloxacin (31.4%). Additionally, more than 25% of isolates were resistant to penicillin and levofloxacin. There was slightly less resistance to clindamycin (12.6%) compared with the state as a whole.

Of the 54,433 *S. aureus* isolates from Florida residents tested in 2009 whose county of residence was known, 8,106 (15.0%) were from patients residing in the North East Region of Florida (Figure 14 and Table 9). The North East Region had a slightly higher proportion of *S. aureus* that was MRSA compared with the state (54.4%), as well as a slightly higher than average proportion of isolates resistant to amoxicillin-clavulanic acid (54.3%) and cefazolin (54.4%), and a substantially higher than average proportion of isolates resistant to erythromycin (81.8%). Penicillin, ciprofloxacin, and levofloxacin also had resistance percentages higher than 25%.

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Of the 54,433 *S. aureus* isolates from Florida residents tested in 2009 whose county of residence was known, 1,506 (2.8%) were from patients residing in the North West Region of Florida (Figure 15 and Table 9). The North West Region had a higher than average proportion of *S. aureus* that was MRSA compared with the state (55.2%), as well as a slightly higher proportion of isolates resistant to amoxicillin-clavulanic acid (55.0%), cefazolin (55.2%), and ciprofloxacin (32.9%). Penicillin and levofloxacin also had resistance percentages higher than 25%. There was substantially lower erythromycin resistance in this region (20.0%).

Of the 54,433 *S. aureus* isolates from Florida residents tested in 2009 whose county of residence was known, 16,673 (30.8%) were from patients residing in the South East Region of Florida (Figure 16 and Table 9). The South East Region had the lowest proportion of *S. aureus* that was MRSA compared with the state (45.4%). The percent of isolates resistant to penicillin, amoxicillin-clavulanic acid, cefazolin, ciprofloxacin, levofloxacin, and erythromycin were also higher than 25%. While still relatively low, there was a slightly higher than average percentage of isolates resistant to clindamycin (23.5%), tetracycline (9.1%) and gentamicin (5.9%).

Of the 54,433 *S. aureus* isolates from Florida residents tested in 2009 whose county of residence was known, 6,896 (12.7%) were from patients residing in the South West Region of Florida (Figure 17 and Table 9). The South West Region had a resistance profile that was very similar to that of the state as a whole. The percent of isolates resistant to oxacillin, penicillin, amoxicillin-clavulanic acid, cefazolin, ciprofloxacin, levofloxacin, and erythromycin were higher than 25%.

Of the 54,433 *S. aureus* isolates from Florida residents tested in 2009 whose county of residence was known, 10,012 (18.5%) were from patients residing in the West Central Region of Florida (Figure 18 and Table 9). The South West Region had a resistance profile that was very similar to that of the state as a whole. The percent of isolates resistant to oxacillin, penicillin, amoxicillin-clavulanic acid, cefazolin, ciprofloxacin, levofloxacin, and erythromycin were higher than 25%.

Resistance rates by county are presented in Table 10.

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Figure 12. *Staphylococcus aureus*, Antibiotic Resistance, East Central Region, Florida 2009

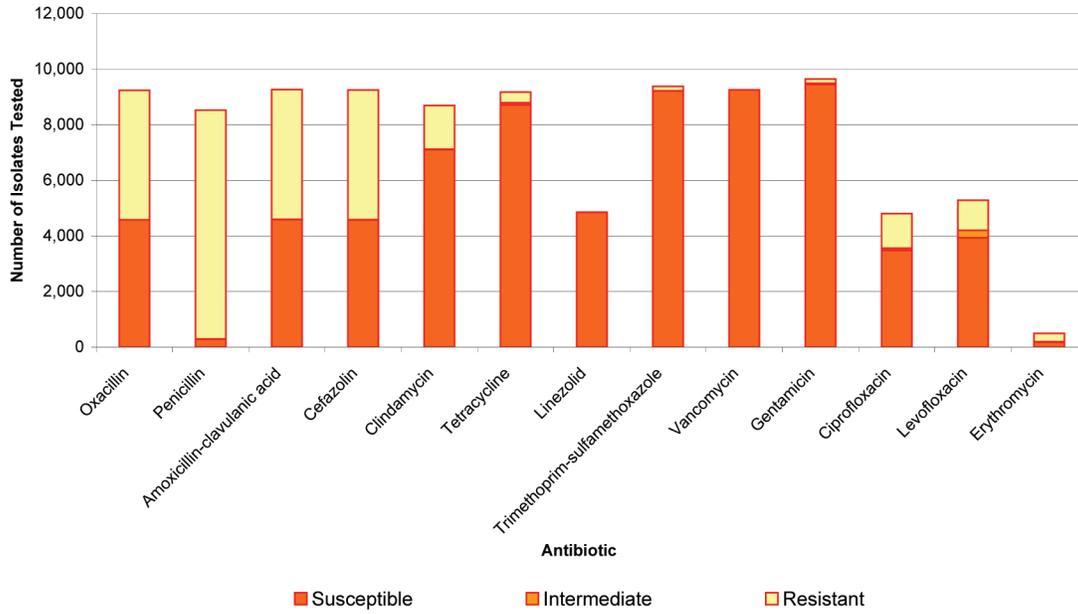
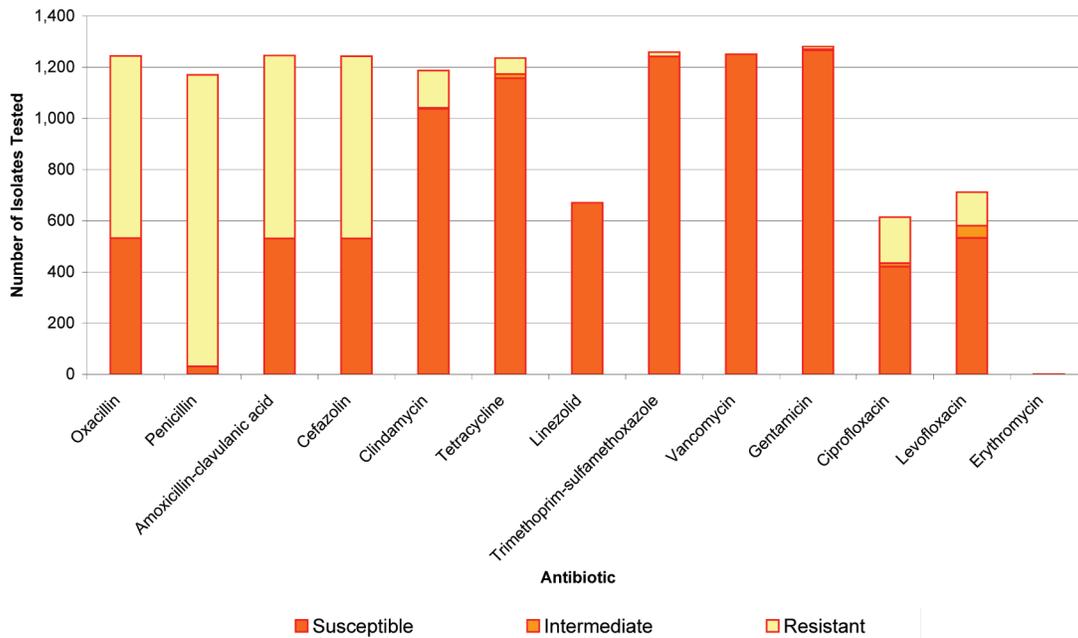


Figure 13. *Staphylococcus aureus*, Antibiotic Resistance, North Central Region, Florida 2009



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Figure 14. *Staphylococcus aureus*, Antibiotic Resistance, North East Region, Florida 2009

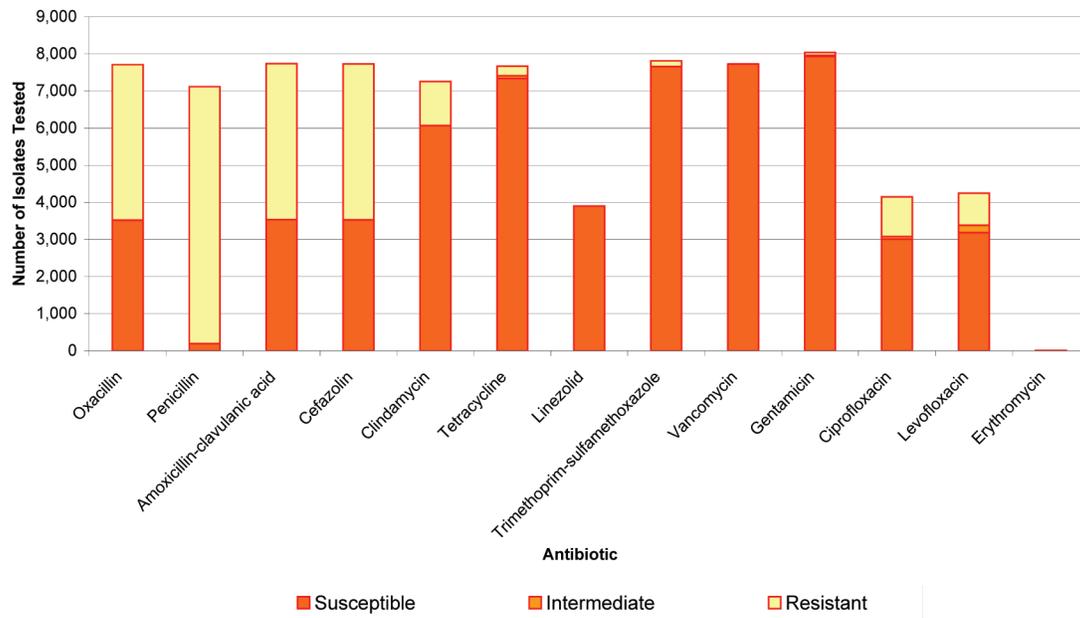
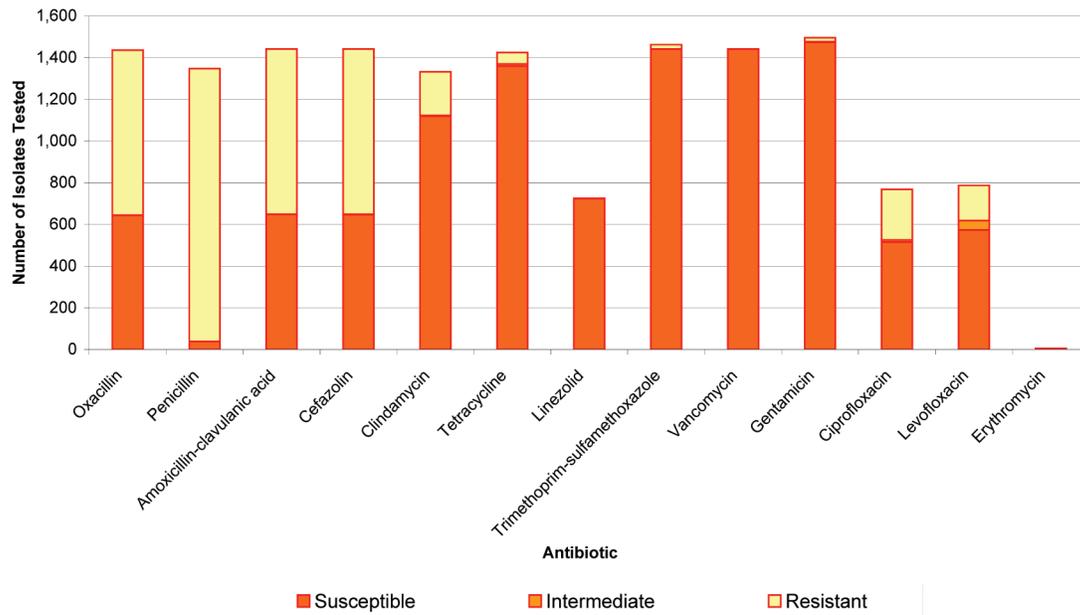


Figure 15. *Staphylococcus aureus*, Antibiotic Resistance, North West Region, Florida 2009



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Figure 16. *Staphylococcus aureus*, Antibiotic Resistance, South East Region, Florida 2009

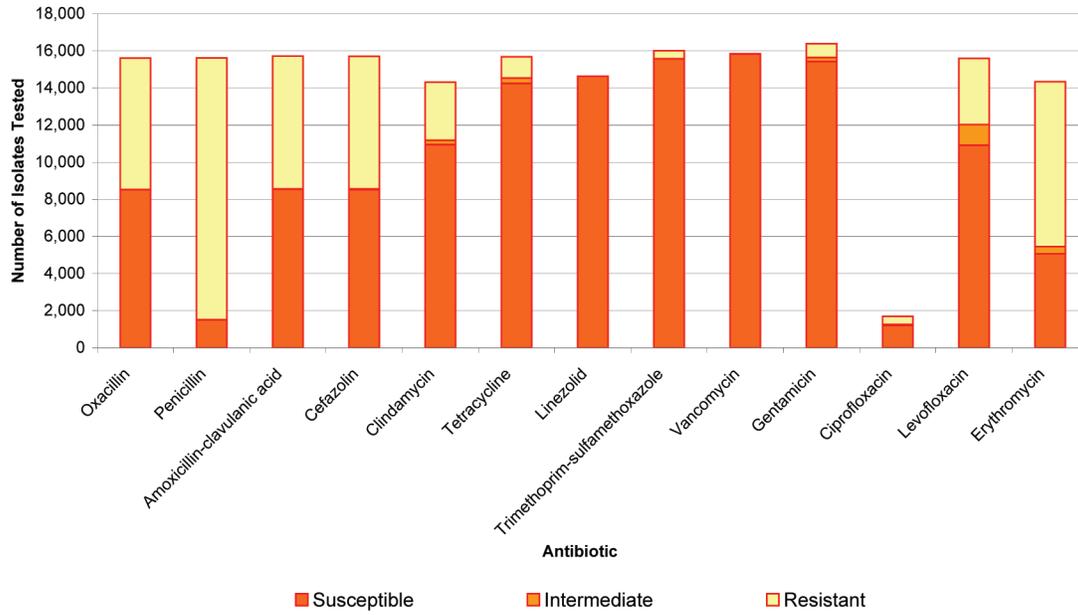
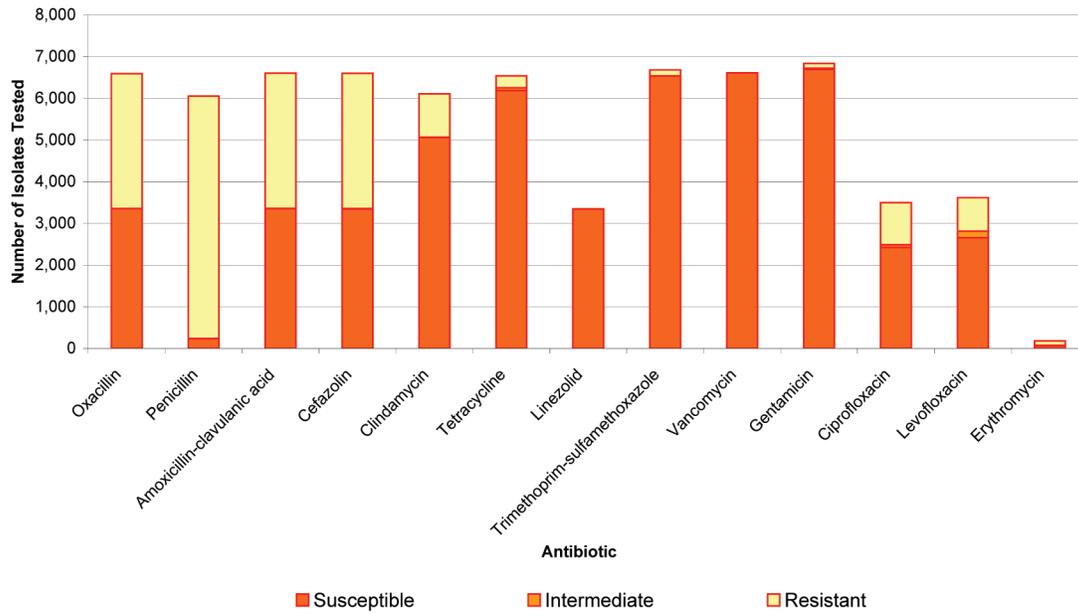


Figure 17. *Staphylococcus aureus*, Antibiotic Resistance, South West Region, Florida 2009



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Figure 18. *Staphylococcus aureus*, Antibiotic Resistance, West Central Region, Florida 2009

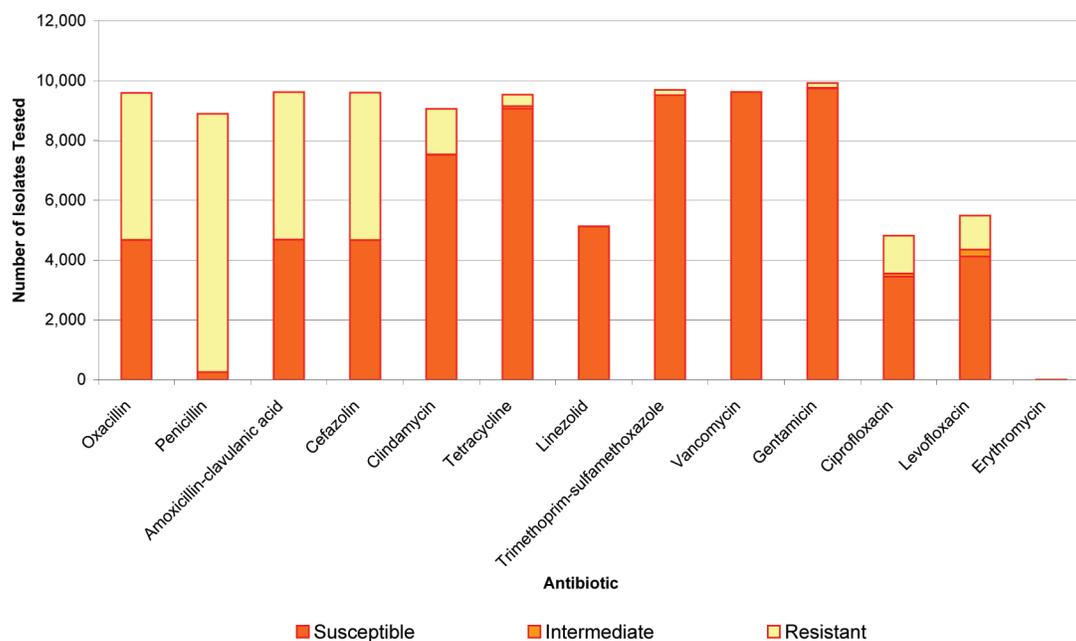


Table 9. Percentage of *Staphylococcus aureus* Isolates with Full or Intermediate Resistance to Antibiotics by Region, Florida 2009

Region	Number of Isolates	Oxacillin*	Penicillin	Amoxicillin-clavulanic acid	Cefazolin	Clindamycin	Tetracycline	Linezolid	Trimethoprim-sulfamethoxazole	Vancomycin	Gentamicin	Ciprofloxacin	Levofloxacin	Erythromycin
East Central	9,729	50.4%	96.6%	50.4%	50.5%	18.3%	5.1%	0.0%	1.8%	0.0%	1.9%	27.5%	25.6%	63.7%
North Central	1,296	57.2%	97.4%	57.4%	57.3%	12.6%	6.4%	0.0%	1.4%	0.0%	1.2%	31.4%	25.1%	0%
North East	8,106	54.4%	97.3%	54.3%	54.4%	16.4%	4.4%	0.0%	2.0%	0.0%	1.4%	27.6%	25.1%	81.8%
North West	1,506	55.2%	97.2%	55.0%	55.2%	16.0%	4.6%	0.1%	1.4%	0.0%	1.4%	32.9%	27.2%	20.0%
South East	10,511	47.3%	90.1%	47.5%	47.6%	22.9%	8.2%	0.0%	2.9%	0.1%†	5.4%	30.0%	30.2%	66.1%
South West	6,896	49.1%	96.1%	49.2%	49.3%	17.2%	5.3%	0.1%	2.2%	0.0%	2.1%	30.7%	26.6%	64.4%
West Central	10,012	51.2%	97.1%	51.3%	51.4%	17.0%	5.0%	0.1%	1.9%	0.0%	1.8%	28.4%	24.9%	70.0%
Total	64,924§	50.2%	94.9%	50.3%	50.4%	18.5%	6.2%	0.0%	2.1%	0.1%	2.9%	28.5%	27.4%	64.7%

*Oxacillin resistance is a marker for MRSA.

§Column does not sum to zero due to missing county values.

†Vancomycin non-susceptible cases are likely false-positives. There were only 6 laboratory-confirmed vancomycin-intermediate *S. aureus* cases reported to the FDOH in 2009. Of those, 2 were in the South East Region, 2 were in the South West Region, and 2 were in the North East Region.

‡Marked observations are those in which too few specimens were tested to produce reliable estimates of resistance.

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Table 10. *Staphylococcus aureus* Isolates, Percentage Resistant to Antibiotics by County, Florida 2009

County	Number of Isolates	Oxacillin*	Penicillin	Amoxicillin-clavulanic acid	Cefazolin	Clindamycin	Tetracycline	Linezolid	Trimethoprim-sulfamethoxazole	Vancomycin	Gentamicin	Ciprofloxacin	Levofloxacin	Erythromycin
Alachua	671	55.1%	96.2%	55.2%	55.3%	13.7%	5.0%	0.0%	2.8%	0.0%	0.7%	24.8%	23.6%	75%*
Baker	137	59.5%	99.2%	59.1%	59.1%	17.1%	2.4%	0.0%	3.1%	0.0%	1.5%	29.1%	27.5%	-
Bay	224	60.9%	96.1%	60.9%	60.9%	12.6%	6.7%	0.0%	2.8%	0.0%	0.9%	37.9%	32.2%	-
Bradford	85	73.5%	100.0%	73.5%	73.5%	14.3%	6.0%	0.0%	6.0%	0.0%	1.2%	38.6%	39.5%	-
Brevard	1,551	53.0%	96.9%	53.2%	53.2%	19.3%	4.3%	0.1%	1.9%	0.1%†	1.0%	31.7%	30.5%	80.0%
Broward	4,769	48.6%	90.2%	48.8%	48.9%	21.5%	8.5%	0.0%	3.2%	0.0%	5.4%	34.0%	31.3%	66.3%
Calhoun	39	43.8%	100.0%	43.8%	43.8%	16.7%	3.1%	0.0%	2.9%	0.0%	2.6%	16.7%	22.7%	-
Charlotte	436	43.6%	96.2%	43.6%	43.6%	22.1%	4.3%	0.0%	2.6%	0.0%	3.7%	28.9%	30.5%	0%*
Citrus	285	55.1%	98.1%	55.1%	55.4%	15.7%	5.5%	0.0%	1.4%	0.0%	1.8%	39.4%	33.1%	100%*
Clay	700	59.1%	97.8%	59.1%	59.1%	15.8%	2.6%	0.0%	1.0%	0.0%	1.2%	26.5%	23.7%	-
Collier	581	38.6%	93.8%	38.6%	38.8%	16.9%	7.0%	0.4%	2.3%	0.0%	1.4%	27.1%	23.9%	66.7%*
Columbia	176	57.1%	95.6%	57.7%	57.5%	13.5%	7.1%	0.0%	1.2%	0.0%	1.2%	43.2%	22.4%	-
DeSoto	43	57.5%	94.4%	57.5%	57.5%	17.9%	5.0%	0.0%	0.0%	0.0%	2.4%	15.8%	26.9%	-
Dixie	126	66.7%	99.2%	66.9%	66.7%	7.9%	9.2%	0.0%	0.0%	0.0%	0.0%	35.6%	30.6%	-
Duval	3,445	55.1%	97.2%	55.2%	55.2%	15.9%	4.6%	0.0%	1.9%	0.0%	1.3%	26.1%	24.6%	100%*
Escambia	240	60.5%	97.7%	59.7%	60.2%	13.7%	6.9%	0.0%	1.7%	0.0%	1.7%	35.3%	28.1%	-
Flagler	153	64.8%	97.8%	64.8%	64.8%	16.5%	5.6%	0.0%	2.1%	0.0%	1.3%	27.0%	29.4%	100%*

*Oxacillin resistance is a marker for MRSA.

†Column does not sum to zero due to missing county values.

‡Vancomycin non-susceptible cases are likely false-positives. There were only 6 laboratory-confirmed vancomycin-intermediate *S. aureus* cases reported to the FDOH in 2009. Of those, 2 were in the South East Region, 2 were in the South West Region, and 2 were in the North East Region.

*Marked observations are those in which too few specimens were tested to produce reliable estimates of resistance.

Section 4: Summary of Antimicrobial Resistance Surveillance

Table 10. (Continued) *Staphylococcus aureus* Isolates, Percentage Resistant to Antibiotics by County, Florida 2009

County	Number of Isolates	Oxacillin*	Penicillin	Amoxicillin-clavulanic acid	Cefazolin	Clindamycin	Tetracycline	Linezolid	Trimethoprim-sulfamethoxazole	Vancomycin	Gentamicin	Ciprofloxacin	Levofloxacin	Erythromycin
Franklin	51	65.3%	100.0%	65.3%	65.3%	8.3%	4.1%	0.0%	2.0%	0.0%	2.0%	34.6%	18.5%	-
Gadsden	78	67.1%	97.1%	67.1%	67.1%	14.5%	5.6%	0.0%	0.0%	0.0%	2.6%	27.0%	23.8%	-
Gilchrist	59	47.2%	100.0%	45.5%	47.2%	15.1%	1.9%	0.0%	5.6%	0.0%	1.8%	14.8%	20.6%	-
Glades	78	50.0%	97.0%	50.0%	51.4%	18.3%	2.7%	0.0%	1.3%	0.0%	1.3%	42.9%	28.9%	73.3%
Gulf	44	61.9%	100.0%	61.9%	61.9%	2.4%	2.4%	0.0%	0.0%	0.0%	0.0%	28.0%	10.5%	-
Hamilton	29	59.3%	100.0%	59.3%	59.3%	7.7%	0.0%	0.0%	0.0%	0.0%	0.0%	37.5%	26.1%	-
Hardee	82	56.8%	100.0%	57.3%	57.3%	6.4%	3.7%	0.0%	1.2%	0.0%	2.4%	27.9%	22.5%	-
Hendry	75	57.7%	94.0%	57.7%	57.7%	16.2%	4.2%	0.0%	2.8%	0.0%	8.1%	33.3%	35.3%	88.9%
Hernando	701	49.5%	94.9%	49.8%	49.5%	22.8%	4.0%	0.0%	2.2%	0.0%	1.9%	35.9%	29.9%	-
Highlands	164	63.3%	98.7%	63.3%	63.3%	13.9%	4.4%	0.0%	0.6%	0.0%	1.8%	22.9%	26.4%	-
Hillsborough	4,403	51.7%	97.6%	51.7%	51.7%	15.9%	4.7%	0.0%	1.9%	0.0%	1.8%	26.7%	22.7%	75%*
Holmes	24	62.5%	95.7%	62.5%	62.5%	4.3%	0.0%	0.0%	0.0%	0.0%	4.2%	53.8%	36.4%	-
Indian River	394	49.1%	97.0%	48.9%	48.9%	15.3%	4.9%	0.0%	0.5%	0.0%	2.0%	33.8%	33.0%	33.3%
Jackson	42	62.5%	100.0%	62.5%	62.5%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	44.4%	31.3%	-
Jefferson	21	70.0%	100.0%	70.0%	70.0%	5.0%	5.0%	0.0%	5.0%	0.0%	4.8%	13.3%	14.3%	-
Lafayette	32	34.5%	100.0%	34.5%	34.5%	17.2%	6.9%	0.0%	0.0%	0.0%	0.0%	22.2%	23.5%	-
Lake	1,006	51.4%	97.0%	51.2%	51.3%	21.3%	4.9%	0.0%	1.1%	0.0%	1.6%	32.3%	27.5%	-

*Oxacillin resistance is a marker for MRSA.

†Column does not sum to zero due to missing county values.

‡Vancomycin non-susceptible cases are likely false-positives.

*Marked observations are those in which too few specimens were tested to produce reliable estimates of resistance.

There were only 6 laboratory-confirmed vancomycin-intermediate *S. aureus* cases reported to the FDOH in 2009. Of those, 2 were in the South East Region, 2 were in the South West Region, and 2 were in the North East Region.

Section 4: Summary of Antimicrobial Resistance Surveillance

Table 10. (Continued) *Staphylococcus aureus* Isolates, Percentage Resistant to Antibiotics by County, Florida 2009

County	Number of Isolates	Oxacillin*	Penicillin	Amoxicillin-clavulanic acid	Cefazolin	Clindamycin	Tetracycline	Linezolid	Trimethoprim-sulfamethoxazole	Vancomycin	Gentamicin	Ciprofloxacin	Levofloxacin	Erythromycin
Lee	1,819	45.8%	96.0%	46.0%	46.1%	15.0%	4.6%	0.1%	1.7%	0.0%	1.3%	27.2%	23.4%	36.4%
Leon	447	48.4%	95.8%	48.6%	48.4%	14.3%	6.5%	0.0%	1.1%	0.0%	1.4%	24.6%	22.9%	0%*
Levy	170	58.3%	99.3%	58.0%	58.3%	14.2%	6.2%	0.0%	2.4%	0.0%	2.4%	37.5%	33.0%	-
Liberty	15	84.6%	100.0%	84.6%	84.6%	15.4%	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%	9.1%	-
Madison	35	67.6%	96.9%	67.6%	67.6%	6.9%	8.8%	0.0%	5.9%	0.0%	2.9%	27.8%	44.4%	-
Manatee	1,349	48.0%	97.1%	47.9%	48.3%	16.0%	5.4%	0.1%	1.5%	0.1%†	0.6%	23.5%	22.0%	-
Marion	1,092	51.8%	97.1%	51.9%	51.7%	19.1%	4.5%	0.0%	1.3%	0.0%	1.6%	31.6%	27.6%	-
Miami-Dade	6,162	42.1%	90.7%	42.4%	42.5%	24.6%	10.6%	0.0%	2.5%	0.2%	6.8%	27.0%	29.8%	62.3%
Martin	562	49.0%	91.2%	49.1%	49.5%	23.4%	7.4%	0.0%	3.1%	0.4%‡	5.8%	23.7%	26.7%	64.2%
Monroe	242	53.1%	88.1%	53.7%	53.7%	18.3%	7.0%	0.0%	1.3%	0.0%	5.0%	34.8%	31.3%	67.1%
Nassau	289	52.8%	96.7%	52.2%	52.2%	20.7%	5.3%	0.0%	3.7%	0.4%‡	1.7%	28.4%	15.2%	0%*
Okaloosa	329	54.2%	95.2%	54.2%	54.5%	17.4%	5.5%	0.0%	1.3%	0.0%	0.9%	41.1%	28.8%	0%*
Okeechobee	44	66.7%	97.3%	66.7%	66.7%	8.8%	2.6%	0.0%	2.5%	0.0%	0.0%	59.3%	33.3%	100%*
Orange	3,000	48.4%	96.9%	48.3%	48.5%	17.5%	5.6%	0.0%	1.7%	0.0%	2.0%	23.6%	21.7%	71.4%
Osceola	792	49.3%	96.7%	49.3%	49.6%	16.9%	4.4%	0.0%	2.1%	0.0%	1.8%	27.3%	24.4%	0%*
Palm Beach	5,500	46.0%	90.1%	46.2%	46.3%	24.3%	8.0%	0.0%	2.6%	0.1%†	5.4%	25.6%	29.1%	65.8%
Pasco	1,519	51.1%	96.4%	51.2%	51.5%	19.3%	5.5%	0.4%	1.4%	0.0%	2.4%	32.6%	28.1%	100%*

*Oxacillin resistance is a marker for MRSA.

†Column does not sum to zero due to missing county values.

‡Vancomycin non-susceptible cases are likely false-positives.

There were only 6 laboratory-confirmed vancomycin-intermediate *S. aureus* cases reported to the FDOH in 2009. Of those, 2 were in the South East Region, 2 were in the South West Region, and 2 were in the North East Region.

*Marked observations are those in which too few specimens were tested to produce reliable estimates of resistance.

Table 10. (Continued) *Staphylococcus aureus* Isolates, Percentage Resistant to Antibiotics by County, Florida 2009

County	Number of Isolates	Oxacillin*	Penicillin	Amoxicillin-clavulanic acid	Cefazolin	Clindamycin	Tetracycline	Linezolid	Trimethoprim-sulfamethoxazole	Vancomycin	Gentamicin	Ciprofloxacin	Levofloxacin	Erythromycin
Pinellas	2,634	51.4%	96.5%	51.4%	51.6%	17.4%	5.1%	0.0%	2.0%	0.0%	1.9%	32.5%	25.6%	66.7%*
Polk	1,361	53.9%	97.3%	53.9%	53.9%	15.4%	5.2%	0.0%	2.7%	0.0%	2.4%	27.1%	26.9%	0%*
Putnam	171	69.8%	98.1%	69.8%	69.8%	9.6%	4.3%	0.0%	2.4%	0.0%	0.6%	33.3%	28.9%	-
Santa Rosa	195	58.3%	96.0%	58.8%	58.3%	14.4%	4.3%	0.0%	0.5%	0.0%	1.0%	33.7%	29.6%	-
Sarasota	1,095	45.0%	97.1%	44.9%	45.0%	18.2%	3.9%	0.0%	1.8%	0.1% [‡]	1.8%	27.4%	25.4%	100%*
Seminole	1,165	48.8%	97.0%	48.8%	48.8%	17.1%	4.8%	0.0%	1.4%	0.0%	1.3%	24.7%	23.4%	100%*
St Johns	460	50.7%	98.5%	50.7%	50.7%	18.9%	3.2%	0.4%	1.1%	0.0%	1.8%	23.7%	24.9%	33.3%*
St Lucie	1,022	53.6%	96.4%	53.6%	53.5%	19.4%	7.4%	0.0%	3.6%	0.0%	3.5%	35.8%	32.4%	63.0%
Sumter	312	47.3%	95.8%	47.1%	47.1%	23.5%	5.2%	0.0%	1.3%	0.0%	1.0%	32.4%	26.1%	-
Suwannee	86	45.8%	97.4%	45.8%	45.8%	20.5%	7.3%	0.0%	2.4%	0.0%	0.0%	36.1%	26.4%	-
Taylor	141	73.5%	100.0%	73.5%	73.5%	7.4%	4.4%	0.0%	2.2%	0.0%	0.0%	37.9%	35.3%	-
Union	39	61.5%	100.0%	61.5%	61.5%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	33.3%	22.2%	-
Volusia	1,064	54.1%	97.2%	54.2%	54.2%	17.7%	4.6%	0.2%	2.6%	0.0%	2.4%	28.6%	26.3%	75%*
Wakulla	59	56.1%	98.1%	55.2%	56.1%	14.3%	7.0%	0.0%	1.7%	0.0%	3.4%	46.4%	12.5%	-
Walton	63	48.3%	98.2%	48.3%	48.3%	24.1%	1.7%	0.0%	1.6%	0.0%	1.6%	32.1%	21.1%	0%*
Washington	41	50.0%	91.2%	50.0%	50.0%	13.9%	2.7%	0.0%	0.0%	0.0%	2.5%	36.4%	35.0%	-
Total	64,924 [§]	50.2%	94.9%	50.3%	50.4%	18.5%	6.2%	0.0%	2.1%	0.1%	2.9%	28.5%	27.4%	64.7%

*Oxacillin resistance is a marker for MRSA.

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†Vancomycin non-susceptible cases are likely false-positives. There were only 6 laboratory-confirmed vancomycin-intermediate *S. aureus* cases reported to the FDOH in 2009. Of those, 2 were in the South East Region, 2 were in the South West Region, and 2 were in the North East Region.

**Marked observations are those in which too few specimens were tested to produce reliable estimates of resistance.

Section 4: Summary of Antimicrobial Resistance Surveillance

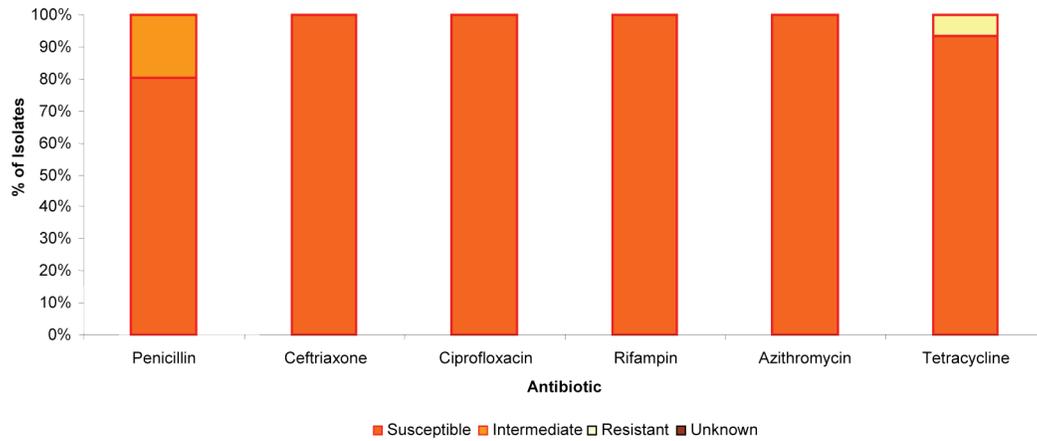
Neisseria meningitidis

Meningococcal disease is an acute, potentially severe illness caused by the bacterium *Neisseria meningitidis*. Invasive meningococcal disease refers to *Neisseria meningitidis* infection in the blood (meningococemia), in the cerebral spinal fluid (meningitis), or from any normally sterile site in the body, such as joints. Common symptoms of meningococcal disease include high fever, neck stiffness, confusion, nausea, vomiting, photophobia, lethargy, and petechiae or a purpuric rash. The currently recommended chemoprophylactic antibiotics include ciprofloxacin, a second-generation fluoroquinolone, which is effectively and frequently prescribed to adults (men and non-pregnant women) because the regimen is simple (a single oral dose), is associated with low rates of adverse events, and has relatively few drug interactions.

The emergence of fluoroquinolone-resistant *Neisseria meningitidis* in the U.S. has raised important questions regarding current chemoprophylaxis guidelines and highlights the expanding threat of antimicrobial resistance in bacterial pathogens. The Centers for Disease Control and Prevention (CDC) responded to this threat by forming MeningNet, an enhanced meningococcal surveillance system used to monitor antimicrobial susceptibility. As part of MeningNet, Florida began forwarding all *N. meningitidis* isolates to the CDC for antibiotic susceptibility testing in late 2008.

Of the 52 cases of meningococcal disease in Florida in 2009, 46 cases had an isolate that was submitted to CDC for testing as part of MeningNet. All 46 isolates from Florida were tested for susceptibility to penicillin, ceftriaxone, ciprofloxacin, rifampin, azithromycin, and tetracycline with the use of the Etest or broth-microdilution panels. Non-susceptible and intermediate isolates were confirmed with the use of broth microdilution. Thirty-seven isolates (80.4%) were susceptible to penicillin and nine (19.6%) had intermediate resistance to penicillin. Those isolates with the highest penicillin G MICs (intermediate resistance with MIC ranging from .125 to .350) consisted of 67% (6 isolates) from serogroup Y, 22% (2 isolates) and 11% (1 isolate) were of serogroups C and B, respectively. All other isolates were fully (100%) susceptible to ceftriaxone, ciprofloxacin, rifampin, and azithromycin. Forty-three (93.5%) of the isolates tested susceptible to tetracycline, and the susceptibility of the other three (6.5%) were undetermined (Figure 19).

Figure 19. *Neisseria meningitidis* Isolates and Level of Susceptibility, Florida 2008-2009



Other Activities

In the 2008 revision to *F.A.C.* Rule 64D-3, Florida made community-associated *S. aureus* mortality a reportable condition. Additionally, antibiotic susceptibilities for all *S. aureus* isolates from sterile sites became reportable via electronic laboratory reporting. This applies only to laboratories participating in electronic laboratory reporting with the Florida Department of Health, and individual case investigations are not required. The goal of this surveillance is to monitor trends of antimicrobial resistance and the data collected through 2009 will be analyzed and included in future reports. The Bureau of Epidemiology is actively pursuing electronic laboratory partners and the amount of data available for analysis will increase over the next years.

