Section 4:

Health Care-Associated Infections (HAIs) and Antimicrobial Resistance

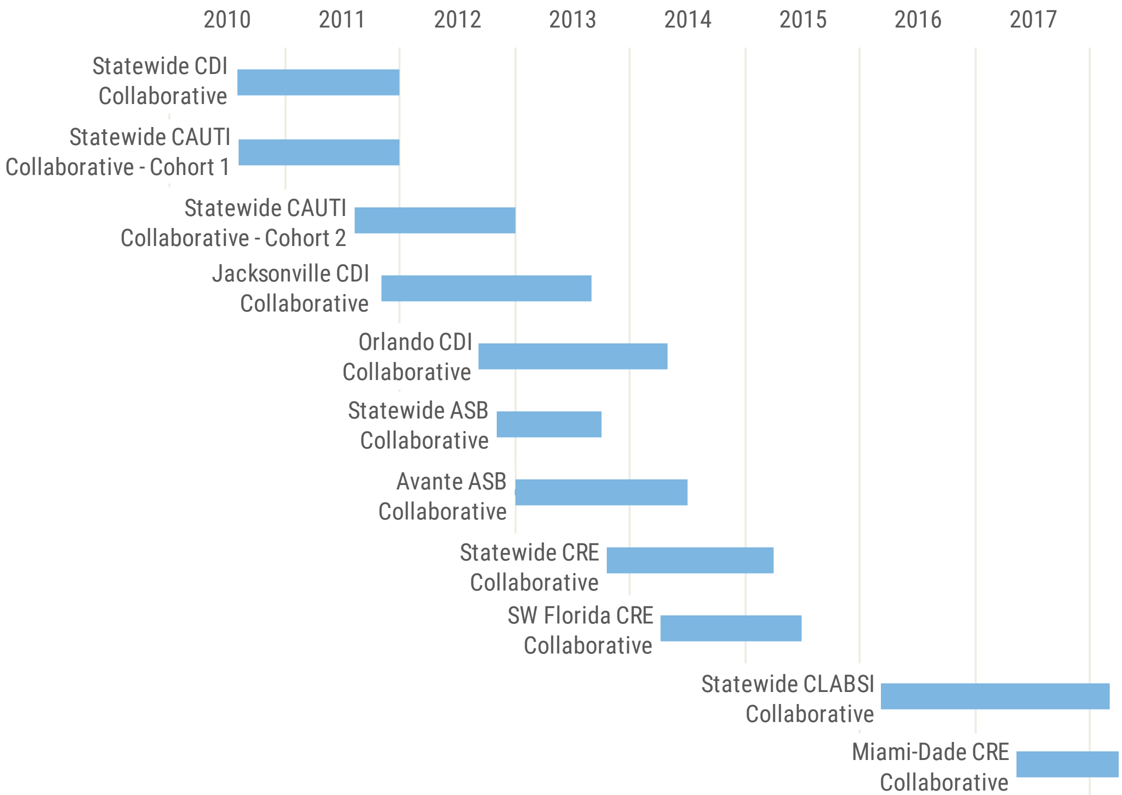
Section 4: HAIs and Antimicrobial Resistance

HAI Background

The Florida Department of Health Care-Associated Infection (HAI) Prevention Program was established in 2010 through the Centers for Disease Control and Prevention (CDC) Epidemiology and Laboratory Capacity cooperative agreement. The HAI Prevention Program goals included:

- Establishing an HAI Prevention Program infrastructure
- Conducting HAI and antimicrobial resistance surveillance
- Engaging in prevention activities with internal and external partners (e.g., supporting county health department investigations, responding to outbreaks, and promoting infection control best practices and judicious use of antibiotics)

Since its installation, the HAI Prevention Program has facilitated a number of statewide and regional collaboratives, working in conjunction with local health care partners to promote effective infection control practices.



Abbreviations: CDI, *Clostridium difficile* infection; CAUTI, catheter-associated urinary tract infection; ASB, asymptomatic bacteriuria; CRE, carbapenem-resistant Enterobacteriaceae; CLABSI, central line-associated bloodstream infection

Over the past few years, antimicrobial resistance has become an urgent public health threat affecting health care, veterinary, and agricultural industries around the world. The increased spread of antimicrobial-resistant organisms has been fueled by modern globalization, increasing the ease by which people, animals, and goods move around the globe. To minimize this threat, the HAI Prevention Program works in concert with local, state, and federal partners to implement containment strategies designed to stop the spread of antimicrobial-resistant organisms through early and aggressive action.

In 2015, CDC created the infection control assessment response (ICAR), which was designed to assess a facility's capability to identify, isolate, inform, prepare for transport, and provide care for persons with highly infectious diseases, such as Ebola. Florida Health accompanied CDC on the first ICAR conducted in a Florida hospital in 2015. Using this experience, in combination with other lessons learned and evidence-based best practices, the HAI Prevention Program created a standardized ICAR assessment process and implemented that process in health care facilities across the continuum of patient care settings.

Section 4: HAIs and Antimicrobial Resistance

HAI Infection Control Assessment Responses (ICARs)

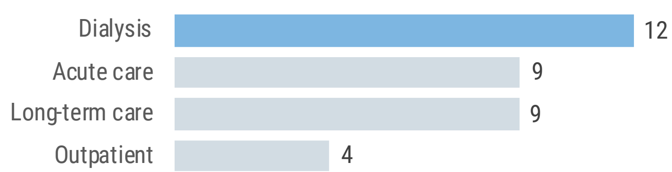
The HAI Prevention Program conducted the majority of ICARs in 2017. During the second half of the year, the Program extended ICARs to the county level to continue the growth of the program and share tools and resources to promote infection prevention.

34 ICARs conducted in 32 facilities in 2017

4 conducted as part of a collaborative

10 conducted in response to outbreak investigations

ICARs were most frequently performed in dialysis facilities in 2017. Dialysis facilities were targeted for ICARs due to patients' increased risk for infection.

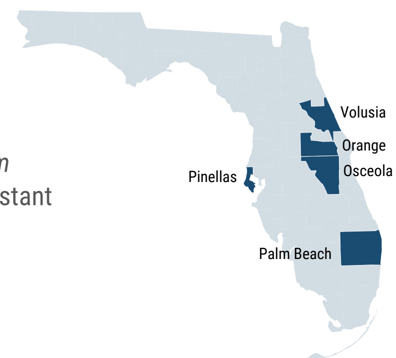


The top three areas where gaps in infection prevention were identified through ICARs were:

- Hand hygiene
- Personal protective equipment
- Environmental cleaning

Facilities were provided with specific recommendations and resources (e.g., auditing tools, checklists, example policies) to address gaps identified during site visits.

In July 2017, the HAI Prevention Program developed a five-person ICAR team focused on conducting ICARs in health care facilities as an infection prevention tool. ICAR team staff were stationed in five county health departments chosen for their previous participation in infection control collaboratives and a high burden of *Clostridium difficile* or carbapenem-resistant Enterobacteriaceae (CRE) infections in their counties.



HAI Collaboratives

The HAI Prevention Program has been facilitating collaboratives since its start in 2010. Collaboratives serve as a way to engage facilities in infection prevention of important organisms. Facilities are provided with education and training, networking opportunities, and on-site assessments. Through the data collected during collaboratives, Florida Health is able to measure the impact of interventions and target regions needing further support.

Statewide CLABSI Collaborative

- March 2016–March 2018
- 8 long-term acute-care hospitals
- Goals:
  - ◊ Prevent, detect, and contain CLABSI
  - ◊ Understand and implement current guidelines for CLABSI detection and prevention
  - ◊ Effective communication across the continuum of care

Miami-Dade CRE Collaborative

- May 2017–December 2018
- 13 acute-care hospitals, 4 nursing homes, 1 inpatient rehabilitation facility, 1 long-term acute-care hospital
- Goals:
  - ◊ Increase awareness of CRE
  - ◊ Increase education on how to prevent CRE infections
  - ◊ Improve detection and surveillance for CRE
  - ◊ Determine prevalence of CRE in Miami-Dade region
  - ◊ Improve communication between health care facilities and transport companies on preventing the spread of CRE
  - ◊ Promote antibiotic stewardship initiatives

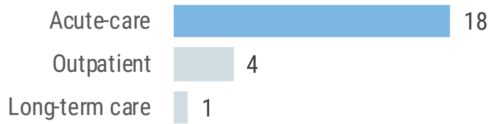
Section 4: HAIs and Antimicrobial Resistance

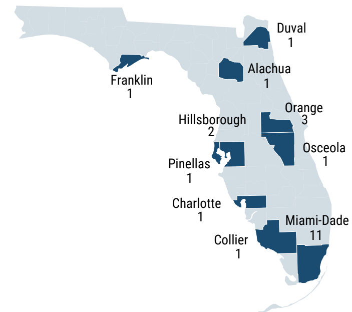
HAI Outbreaks

The HAI Program works with county health departments and health care facilities to assist in the development of plans for prompt response to multidrug-resistant microorganisms to prevent transmission. These plans assist in coordinating investigations, including on-site infection control assessments, health care personnel observations, and colonization screening.

23 outbreaks in **10** counties of multidrug-resistant organisms reported in 2017

Majority were identified in **acute-care** facilities





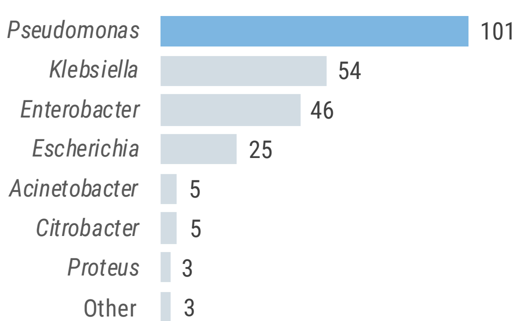
8 facilities received on-site assistance

HAI Laboratory Testing

CRE is a drug-resistant family of bacteria that has gained media attention as a significant threat to human health due to its high levels of resistance to antibiotics. To further improve surveillance and awareness of CRE, Florida Health's Bureau of Public Health Laboratories (BPHL) expanded CRE testing capabilities in 2017 to identify types of resistance mechanisms used by organisms. Carbapenemase production is a resistance mechanism of concern. A carbapenemase is an enzyme that breaks down carbapenem antibiotics and can be transferred between organisms. A variety of carbapenemases have been reported in the U.S. and in Florida: *Klebsiella pneumoniae* carbapenemase (KPC), Verona integron-encoded metallo-β-lactamase (VIM), New Delhi metallo-β-lactamase (NDM), and oxicillinase (OXA)-48-like.

263 isolates tested by BPHL for CRE mechanism in 2017

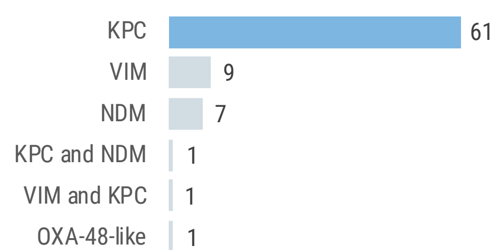
Pseudomonas* was most common organism identified



*In response to an outbreak, Florida Health requested that all *Pseudomonas* isolates from the facility involved be sent to BPHL for additional testing.

30% of isolates tested were carbapenemase-producing

KPC was most common resistance mechanism



Section 4: HAIs and Antimicrobial Resistance

Antimicrobial Resistance Key Points

Streptococcus pneumoniae in 2017

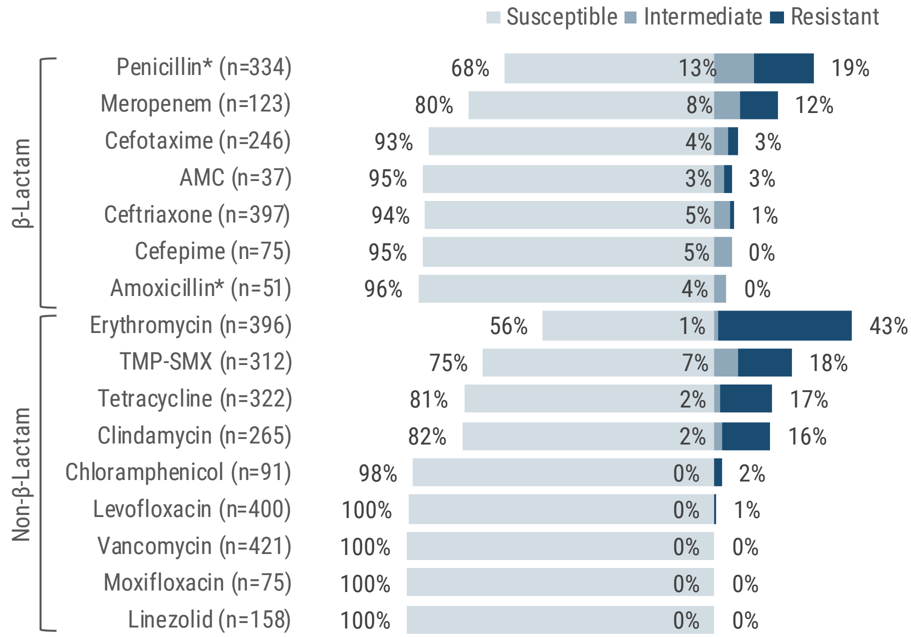
624 *S. pneumoniae* invasive disease cases reported

40% had isolates resistant to at least one antibiotic

19% resistant to penicillin and **0%** resistant to amoxicillin
(recommended first-line antibiotics)

Organism Facts

- Gram-positive, facultative anaerobic bacterium
- Major cause of pneumonia and meningitis
- Transmitted via direct contact



AMC=amoxicillin/clavulanate
TMP-SMX=trimethoprim/sulfamethoxazole
* Recommended first-line antibiotics, according to *The Sanford Guide to Antimicrobial Therapy 2018*

S. pneumoniae susceptibility data for 2013–2017

Antibiotic type	Antibiotic name	2013 Number tested	2013 Percent susceptible	2014 Number tested	2014 Percent susceptible	2015 Number tested	2015 Percent susceptible	2016 Number tested	2016 Percent susceptible	2017 Number tested	2017 Percent susceptible
β-Lactam	Amoxicillin*	138	95%	105	97%	21	86%	32	97%	51	96%
	AMC	182	90%	115	90%	22	95%	33	88%	37	95%
	Cefepime	157	96%	113	91%	24	100%	46	100%	75	95%
	Cefotaxime	525	92%	329	93%	93	94%	135	96%	246	93%
	Ceftriaxone	900	93%	599	93%	177	92%	249	96%	397	94%
	Imipenem	27	85%	8	63%	5	100%	7	100%	19	89%
	Meropenem	338	87%	229	89%	49	84%	87	89%	123	80%
	Penicillin*	967	72%	618	72%	158	69%	234	71%	334	68%
Non-β-Lactam	Chloramphenicol	238	96%	180	98%	52	96%	71	96%	91	98%
	Clindamycin	396	82%	306	81%	79	73%	133	84%	265	82%
	Erythromycin	840	58%	581	56%	187	49%	256	52%	396	56%
	Levofloxacin	774	99%	567	99%	138	98%	227	95%	400	100%
	Linezolid	193	99%	185	100%	46	100%	78	100%	158	100%
	Moxifloxacin	194	99%	159	99%	37	97%	47	89%	75	100%
	Ofloxacin	55	96%	65	94%	19	89%	34	91%	27	85%
	Rifampin	42	98%	23	100%	7	100%	15	100%	22	100%
	Tetracycline	566	81%	406	78%	98	73%	177	76%	322	81%
	TMP-SMX	680	70%	462	73%	114	68%	172	69%	312	75%
	Vancomycin	962	100%	654	100%	174	100%	253	99%	421	100%

Due to inconsistencies in laboratory reporting formats, meningitis and non-meningitis breakpoints for penicillin and ceftriaxone results cannot be separated. This report includes *S. pneumoniae* invasive disease data from cases that were reported to Florida Health by health care providers and laboratories as part of mandatory case-based disease reporting. If multiple isolates were tested for one case, the most recent results were included in the analysis. When both a susceptible and resistant result were reported for one of these antibiotics on the same laboratory result, the resistant result was used for analysis.

AMC=amoxicillin/clavulanate
TMP-SMX=trimethoprim/sulfamethoxazole
* Recommended first-line antibiotics, according to *The Sanford Guide to Antimicrobial Therapy 2018*

Section 4: HAIs and Antimicrobial Resistance

Antimicrobial Resistance Key Points (Continued)

Staphylococcus aureus in 2017

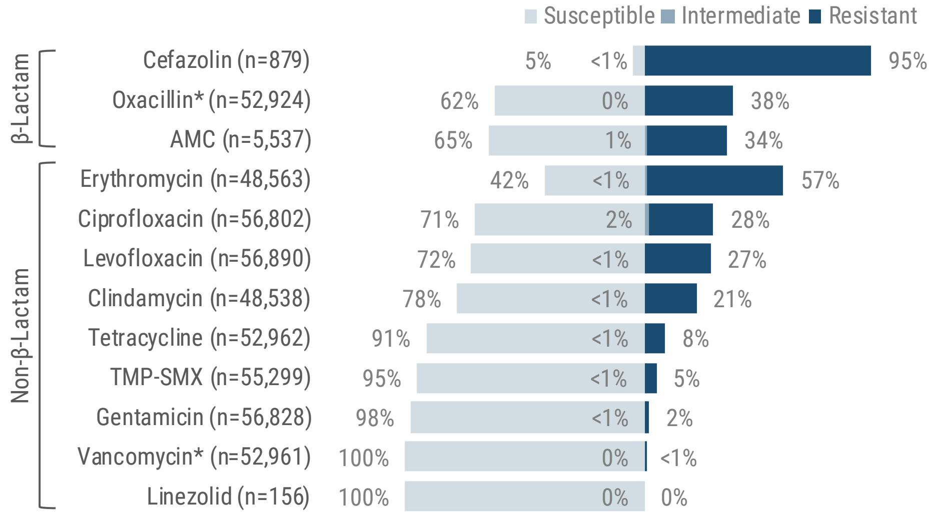
57,095 isolates reported

38% resistant to oxacillin (i.e., MRSA)
(susceptibility testing now done on oxacillin rather than methicillin)

0% resistant to vancomycin
(recommended first-line antibiotic when resistant to oxacillin)

Organism Facts

- Gram-positive bacterium, often part of body's normal flora, frequently found in nose, respiratory tract, and on skin
- Leading cause of skin and soft tissue infections
- Transmitted via direct contact



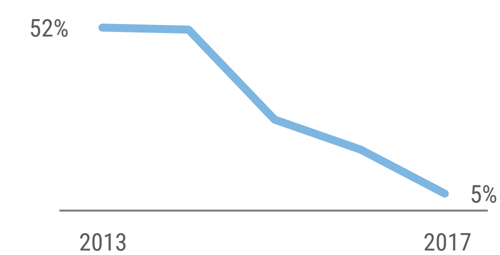
AMC=amoxicillin/clavulanate
TMP-SMX=trimethoprim/sulfamethoxazole
* Recommended first-line antibiotics, according to *The Sanford Guide to Antimicrobial Therapy 2018*

S. *aureus* susceptibility data for 2013–2017

Antibiotic type	Antibiotic name	2013 Number tested	2013 Percent susceptible	2014 Number tested	2014 Percent susceptible	2015 Number tested	2015 Percent susceptible	2016 Number tested	2016 Percent susceptible	2017 Number tested	2017 Percent susceptible
β-Lactam	AMC	50,178	53%	53,455	54%	29,442	56%	17,424	59%	5,537	65%
	Cefazolin	16,740	52%	717	51%	723	26%	909	17%	879	5%
	Oxacillin*	51,579	53%	55,990	54%	55,303	58%	53,902	60%	52,924	62%
Non-β-Lactam	Ciprofloxacin	55,714	66%	57,633	63%	57,895	67%	57,371	69%	56,802	71%
	Clindamycin	47,831	78%	52,191	76%	51,506	77%	49,553	77%	48,538	78%
	Erythromycin	47,843	35%	52,192	35%	51,519	38%	49,596	40%	48,563	42%
	Gentamicin	56,032	97%	57,629	96%	57,921	97%	57,378	97%	56,828	98%
	Levofloxacin	56,151	70%	57,690	68%	57,958	70%	57,422	71%	56,890	72%
	Linezolid	189	100%	262	100%	203	100%	178	100%	156	100%
	Tetracycline	51,678	93%	56,103	92%	55,353	92%	53,933	91%	52,962	91%
	TMP-SMX	54,468	97%	56,951	97%	56,821	96%	55,925	95%	55,299	95%
	Vancomycin*	51,686	100%	56,097	100%	55,394	100%	53,967	100%	52,961	100%

AMC=amoxicillin/clavulanate
TMP-SMX=trimethoprim/sulfamethoxazole
* Recommended first-line antibiotics, according to *The Sanford Guide to Antimicrobial Therapy 2018*

Susceptibility to cefazoline decreased notably from 52% to 5% since 2013. Susceptibility to other antibiotics remained relatively stable over the past five years.



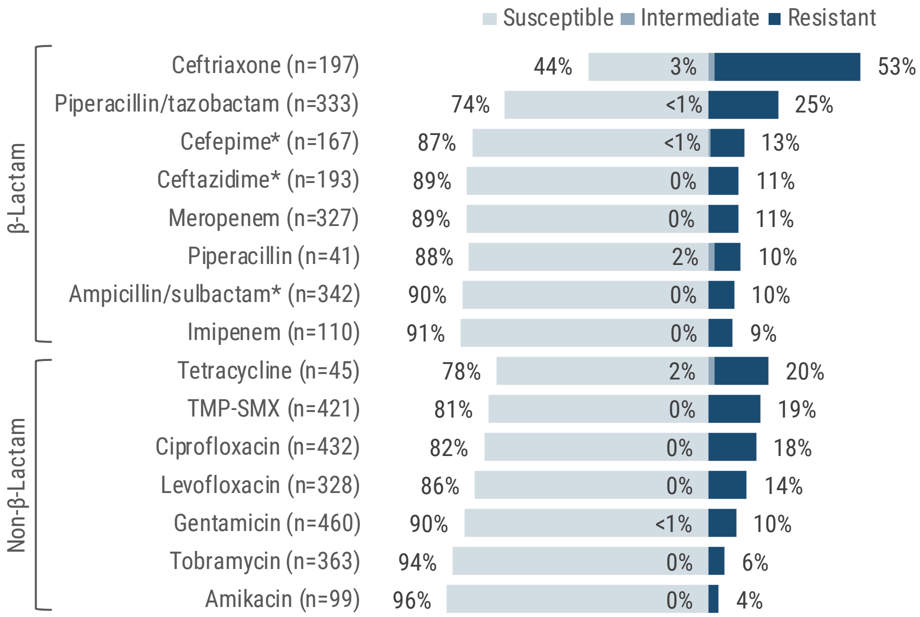
Commercial laboratory partnership

Since 2006, Florida Health has partnered with one of the largest commercial laboratories in the state to receive antimicrobial resistance testing results for all *S. aureus* isolates tested there. Resistance data presented here are from this commercial facility only.

Section 4: HAIs and Antimicrobial Resistance

Antimicrobial Resistance Key Points (Continued)

Acinetobacter species in 2017



TMP-SMX=trimethoprim/sulfamethoxazole
* Recommended first-line antibiotics, according to *The Sanford Guide to Antimicrobial Therapy 2018*
Note: indeterminate results not included in this figure

498 isolates reported

11% resistant to one or more carbapenems (doripenem, ertapenem, imipenem, meropenem)

10–13% resistant to recommended antibiotics: cefepime, ceftazidime, ampicillin/sulbactam

Organism Facts

- Gram-negative bacteria, frequently found in soil and water; *A. baumannii* is most common species causing disease in humans
- Causes pneumonia, blood infections, meningitis, urinary tract infections, skin or wound infections
- Transmitted via direct contact

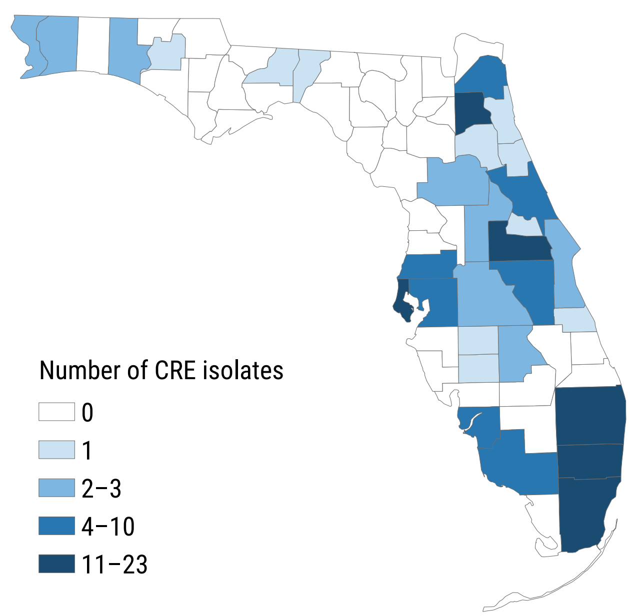
Enterobacteriaceae in 2017

28,166 isolates reported

0.6% resistant to carbapenem (i.e., CRE)

Organism Facts

- Family of bacteria that includes *Escherichia coli*, *Klebsiella pneumoniae*, *Salmonella* species, and *Shigella* species
- Often occur in health care settings in patients who require devices or antibiotic therapy
- Transmission depends on organism



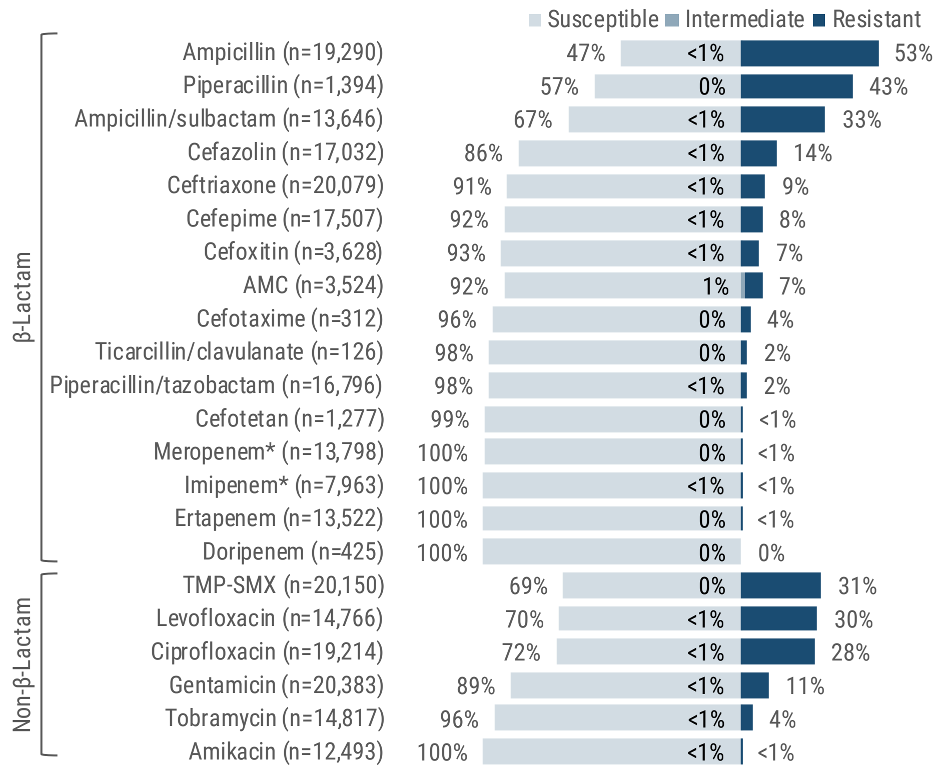
Antimicrobial Resistance Key Points (Continued)

Escherichia coli in 2017

20,523 isolates reported

0.2% resistant to one or more carbapenems (i.e., CRE)

<1% resistant to imipenem or meropenem (recommended first-line antibiotics)



Organism Facts

- Gram-negative, facultative aerobic bacterium, frequently found in lower intestine
- Cause of food poisoning, pneumonia, breathing problems, and urinary tract infections
- Transmitted via fecal-oral route

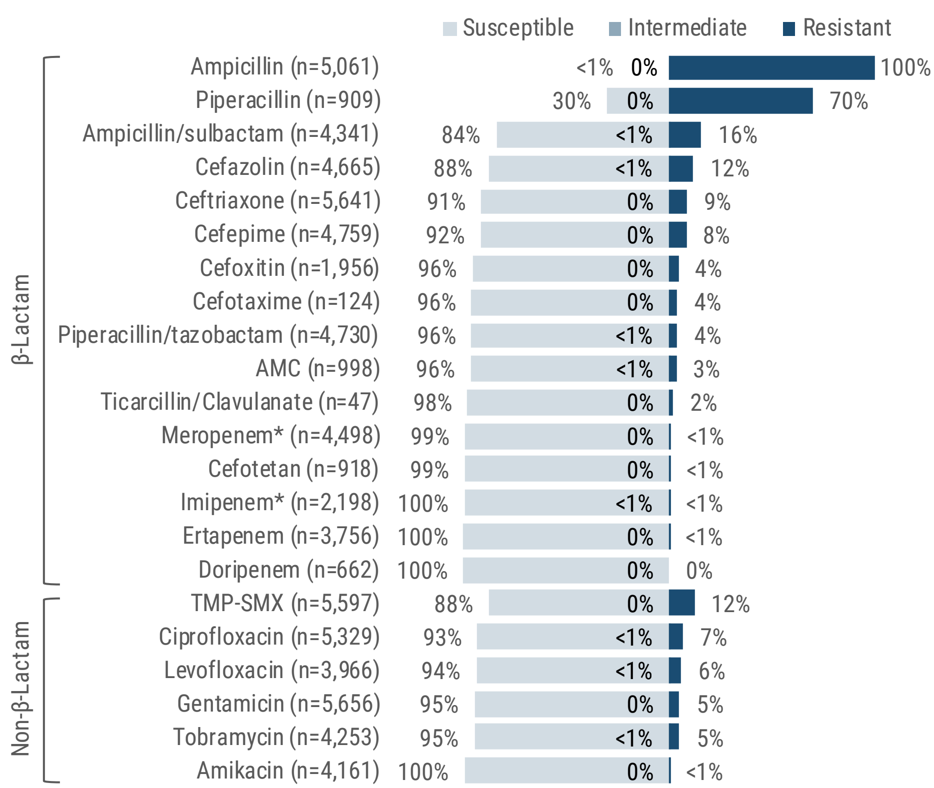
AMC=amoxicillin/clavulanate
TMP-SMX=trimethoprim/sulfamethoxazole
* Recommended first-line antibiotics, according to *The Sanford Guide to Antimicrobial Therapy 2018*
Note: indeterminate results not included in this figure

Klebsiella species in 2017

5,761 isolates reported

0.8% resistant to one or more carbapenems (i.e., CRE)

<1% resistant to imipenem or meropenem (recommended first-line antibiotics)



Organism Facts

- Ubiquitous, gram-negative bacteria; *K. oxytoca* and *K. pneumoniae* are most common species causing disease
- Causes food poisoning, pneumonia, breathing problems, urinary tract infections
- Transmitted via direct contact

AMC=amoxicillin/clavulanate
TMP-SMX=trimethoprim/sulfamethoxazole
* Recommended first-line antibiotics, according to *The Sanford Guide to Antimicrobial Therapy 2018*
Note: indeterminate results not included in this figure

Antimicrobial Resistance Surveillance Methods

Antimicrobial resistance is the ability of a microorganism to evade antimicrobial treatment. One reason microorganisms have become resistant to antibiotics is that they are often inappropriately used to treat infections with the wrong dose, duration, or drug choice. Antibiotics are often prescribed for viral infections such as a cold or flu, or to treat bacteria in urine in the absence of symptoms, neither of which require antibiotic treatment. In the food industry, antibiotics are used to treat diseased animals. Giving antibiotics to food animals can foster resistance in bacteria. These organisms can contaminate meat when the animal is slaughtered and processed, or enter the environment from manure that is used for fertilizer or through irrigation, and make their way into the food supply and ultimately infect humans. Infections caused by drug-resistant organisms are difficult to treat and often require extended hospital stays, treatment with more toxic drugs, and increased medical costs.

Antimicrobial resistance can be reduced by improving infection control practices, reducing overuse and improper use of antibiotics, tracking and reporting resistance rates, improving laboratory capacity, and developing new drugs. Surveillance data are used to identify occurrences of novel resistant organisms, analyze trends over time, target facilities for interventions to improve antibiotic prescribing, and guide empiric therapy.

Case-based surveillance

As of 2017, health care providers and laboratories must report antimicrobial resistance testing results to Florida Health for:

- *Streptococcus pneumoniae* isolates from normally sterile sites, such as blood or cerebrospinal fluid
    - ◊ Starting in June 2014, only laboratories participating in electronic laboratory reporting (ELR) are required to submit such results for people ≥6 years old. All laboratories are required to submit test results for children <6 years old.
- *Staphylococcus aureus* isolates that are not susceptible to vancomycin
- *Mycobacterium tuberculosis*
    - ◊ Specimens for all tuberculosis cases must be forwarded to the Florida Health Bureau of Public Health Laboratories for *M. tuberculosis* testing; all positive samples undergo a rapid test for isoniazid and rifampin resistance.
    - ◊ For information on M. tuberculosis resistance, see Section 1: Data Summaries for Common Reportable Diseases/ Conditions.

Electronic laboratory reporting (ELR) surveillance

Since June 2014, all laboratories participating in ELR must report antimicrobial resistance testing results for all *Acinetobacter baumannii*, *Citrobacter* species, *Enterococcus* species, *Enterobacter* species, *Escherichia coli*, *Klebsiella* species, *Pseudomonas aeruginosa*, *Serratia* species, and *S. aureus* isolates from normally sterile sites. Due to the high volume of antimicrobial resistance testing results received electronically, Florida Health does not review results individually. Resistance results are processed electronically in the state's reportable disease surveillance system. Any results that do not meet technical standards for reporting or contain errors are excluded from processing and from this report. Note that only the first isolate per person organism per 365 days was included in the analysis. Due to the number of individual species received, the antibiogram in this report includes those organisms which are of most concern and most commonly found in reports on antimicrobial resistance.

Antimicrobial Resistance Appendix: 2017 Antibiogram

Antibiotic type	Antibiotic agent	*Acinetobacter baumannii* Total Tested	*Acinetobacter baumannii* Percent Susceptible	*Citrobacter freundii* Total Tested	*Citrobacter freundii* Percent Susceptible	*Citrobacter koseri* Total Tested	*Citrobacter koseri* Percent Susceptible	*Enterobacter aerogenes* Total Tested	*Enterobacter aerogenes* Percent Susceptible	*Enterobacter cloacae* Total Tested	*Enterobacter cloacae* Percent Susceptible
β-Lactam	AMC	--		25	0%	18	100%	33	0%	116	1%
	Ampicillin	115	0%	12	8%	11	0%	16	6%	80	9%
	Ampicillin/Sulbactam	309	87%	5	20%	3	100%	8	0%	34	9%
	Aztreonam	68	0%	56	86%	61	97%	26	73%	138	78%
	Cefazolin	131	0%	90	0%	49	92%	75	0%	202	1%
	Cefepime	143	78%	80	96%	82	100%	68	99%	275	89%
	Cefotaxime	14	64%	9	56%	4	100%	9	78%	39	72%
	Cefotetan	1	0%	5	0%	1	100%	4	0%	11	0%
	Cefoxitin	72	0%	59	0%	13	92%	55	0%	111	1%
	Ceftazidime	198	73%	80	80%	20	100%	72	75%	158	78%
	Ceftriaxone	292	16%	130	82%	85	98%	102	79%	270	74%
	Cefuroxime	--		--	--	--		1	0%	2	50%
	Doripenem	15	27%	4	100%	1	100%	3	100%	8	100%
	Ertapenem	--		95	100%	67	100%	67	100%	140	96%
	Imipenem	37	86%	69	94%	19	100%	59	97%	83	87%
	Meropenem	279	87%	75	97%	76	100%	57	96%	252	94%
	Oxacillin	--		--		--		--		1	100%
	Penicillin	--		--		--		--		1	100%
	Piperacillin	41	73%	8	50%	2	0%	6	50%	29	52%
	Piperacillin/tazobactam	282	70%	79	89%	87	100%	71	82%	260	79%
Non β-Lactam	Amikacin	70	93%	64	100%	70	99%	37	100%	211	100%
	Chloramphenicol	--		--		--		--		--	
	Ciprofloxacin	321	78%	120	91%	88	100%	93	98%	267	94%
	Clindamycin	--		--		--		--		2	100%
	Daptomycin	--		--		--		1	100%	3	100%
	Doxycycline	--		1	100%	--		3	100%	8	88%
	Erythromycin	--		--		--		1	0%	2	100%
	Gentamicin	348	85%	133	95%	93	99%	110	97%	305	96%
	Levofloxacin	248	80%	95	88%	40	100%	96	99%	241	93%
	Linezolid	--		--		--		--		2	100%
	Minocycline	16	63%	--		--		--		--	
	Moxifloxacin	--		--		--		--		--	
	Nitrofurantoin	46	0%	45	100%	14	100%	36	17%	44	57%
	Norfloxacin	1	0%	--		--		--		--	
	Ofloxacin	--		--		--		--		--	
	Rifampin	--		--		--		--		1	100%
	Tetracycline	35	69%	22	86%	11	100%	23	91%	100	81%
	Tobramycin	316	91%	77	94%	89	99%	54	96%	257	95%
	Trimethoprim	9	89%	4	100%	3	100%	10	100%	35	77%
	TMP-SMX	306	81%	129	91%	86	100%	100	96%	275	88%
	Vancomycin	--		--		--		1	100%	3	100%

AMC=amoxicillin/clavulanate

TMP-SMX=trimethoprim/sulfamethoxazole

Note that indeterminate results are included in this table. The percent susceptible is unreliable when less than 30 isolates are tested.

Antimicrobial Resistance Surveillance Methods

Antibiotic type	Antibiotic agent	*Enterococcus avium* Total Tested	*Enterococcus avium* Percent Susceptible	*Enterococcus faecalis* Total Tested	*Enterococcus faecalis* Percent Susceptible	*Enterococcus faecium* Total Tested	*Enterococcus faecium* Percent Susceptible	*Escherichia coli* Total Tested	*Escherichia coli* Percent Susceptible	*Haemophilus influenzae* Total Tested	*Haemophilus influenzae* Percent Susceptible
β-Lactam	AMC	4	0%	134	100%	40	15%	3,945	82%	24	96%
	Ampicillin	118	91%	3,154	99%	372	28%	19,500	46%	798	66%
	Ampicillin/Sulbactam	5	80%	4	25%	1	0%	17,249	53%	11	100%
	Aztreonam	1	100%	4	50%	--		7,531	92%	1	100%
	Cefazolin	--		4	25%	--		17,370	85%	1	100%
	Cefepime	1	100%	7	86%	--		17,512	92%	10	100%
	Cefotaxime	--		3	33%	--		312	96%	657	98%
	Cefotetan	--		1	100%	--		1,284	99%	--	
	Cefoxitin	--		1	100%	--		3,987	85%	--	
	Ceftazidime	--		2	50%	--		7,500	91%	--	
	Ceftriaxone	2	50%	7	57%	--		20,174	90%	105	96%
	Cefuroxime	--		--		--		23	100%	42	98%
	Doripenem	--		--		--		424	100%	--	
	Ertapenem	1	100%	3	100%	--		13,521	100%	1	100%
	Imipenem	3	100%	4	75%	--		7,964	100%	22	100%
	Meropenem	1	100%	5	100%	--		13,799	100%	33	100%
	Oxacillin	1	0%	1	0%	--		2	50%	--	
	Penicillin	48	96%	957	99%	121	36%	10	60%	--	
	Piperacillin	--		1	0%	--		1,439	55%	--	
	Piperacillin/tazobactam	1	100%	4	75%	--		17,232	95%	1	100%
Non β-Lactam	Amikacin	1	100%	5	100%	--		12,509	100%	1	100%
	Chloramphenicol	12	92%	277	94%	44	100%	--		660	97%
	Ciprofloxacin	50	84%	2,065	72%	174	24%	19,281	71%	2	100%
	Clindamycin	1	0%	4	75%	--		10	90%	--	
	Daptomycin	31	100%	1,891	100%	35	100%	4	100%	--	
	Doxycycline	26	38%	1,032	22%	101	26%	31	87%	--	
	Erythromycin	53	26%	2,005	9%	190	6%	11	45%	--	
	Gentamicin	10	100%	138	70%	37	84%	20,441	89%	1	100%
	Levofloxacin	50	64%	2,115	73%	209	22%	14,882	70%	51	100%
	Linezolid	61	97%	2,496	100%	304	100%	6	100%	--	
	Minocycline	12	25%	183	17%	--		4	100%	--	
	Moxifloxacin	1	100%	--		--		--		--	
	Nitrofurantoin	14	36%	1,464	99%	146	14%	15,137	96%	--	
	Norfloxacin	11	82%	274	51%	41	24%	--		--	
	Ofloxacin	--		--		--		--		29	100%
	Rifampin	7	86%	210	56%	19	21%	2	100%	30	100%
	Tetracycline	33	33%	1,783	22%	157	27%	2,064	73%	44	57%
	Tobramycin	1	100%	6	83%	--		15,967	89%	1	100%
	Trimethoprim	--		--		--		263	68%	8	63%
	TMP-SMX	3	67%	5	60%	--		20,147	69%	688	63%
	Vancomycin	120	100%	3,285	98%	387	56%	15	93%	--	

AMC=amoxicillin/clavulanate

TMP-SMX=trimethoprim/sulfamethoxazole

Note that indeterminate results are included in this table. The percent susceptible is unreliable when less than 30 isolates are tested.

Antimicrobial Resistance Appendix: 2017 Antibiogram

Antibiotic type	Antibiotic agent	*Klebsiella pneumoniae* Total Tested	*Klebsiella pneumoniae* Percent Susceptible	*Klebsiella oxytoca* Total Tested	*Klebsiella oxytoca* Percent Susceptible	*Pseudomonas aeruginosa* Total Tested	*Pseudomonas aeruginosa* Percent Susceptible	*Serratia marcescens* Total Tested	*Serratia marcescens* Percent Susceptible	*Staphylococcus epidermidis* Total Tested	*Staphylococcus epidermidis* Percent Susceptible
β-Lactam	AMC	985	94%	44	95%	7	43%	89	0%	298	37%
	Ampicillin	4,833	0%	245	0%	805	1%	41	0%	487	0%
	Ampicillin/Sulbactam	4,465	79%	189	62%	800	1%	21	5%	495	16%
	Aztreonam	2,660	93%	133	95%	221	54%	211	99%	1	100%
	Cefazolin	4,516	88%	197	72%	822	0%	225	0%	419	28%
	Cefepime	4,561	91%	202	96%	3,057	90%	322	98%	3	100%
	Cefotaxime	111	95%	13	100%	11	0%	25	88%	1	0%
	Cefotetan	918	99%	3	100%	--		6	0%	--	
	Cefoxitin	1,906	94%	76	93%	583	1%	75	0%	3	67%
	Ceftazidime	1,799	94%	81	94%	1,978	88%	153	94%	--	
	Ceftriaxone	5,380	91%	270	95%	1,108	1%	372	95%	318	50%
	Cefuroxime	3	100%	--		--		1	0%	--	
	Doripenem	659	100%	3	100%	20	25%	6	100%	--	
	Ertapenem	3,568	100%	189	100%	7	29%	255	100%	1	100%
	Imipenem	2,093	99%	109	100%	1,223	90%	18	94%	122	34%
	Meropenem	4,327	99%	173	100%	2,260	91%	286	99%	1	100%
	Oxacillin	--		--		3	33%	--		2,368	39%
	Penicillin	2	50%	--		1	100%	--		1,131	4%
	Piperacillin	965	28%	6	67%	92	65%	15	93%	--	
	Piperacillin/tazobactam	4,687	93%	199	95%	2,524	94%	68	88%	1	0%
Non β-Lactam	Amikacin	4,013	100%	153	100%	1,908	98%	244	100%	1	100%
	Chloramphenicol	--		--		--		--		66	98%
	Ciprofloxacin	5,185	91%	235	97%	2,961	84%	334	95%	1,968	48%
	Clindamycin	--		--		4	75%	--		1,842	54%
	Daptomycin	--		--		7	100%	--		1,095	100%
	Doxycycline	12	67%	--		2	0%	1	100%	704	87%
	Erythromycin	--		--		6	17%	--		1,932	29%
	Gentamicin	5,434	94%	269	99%	3,160	91%	382	97%	2,414	84%
	Levofloxacin	3,889	92%	163	98%	2,574	79%	217	94%	2,325	47%
	Linezolid	1	100%	--		5	100%	--		2,165	100%
	Minocycline	10	80%	--		--		--		143	100%
	Moxifloxacin	1	100%	--		--		--		747	65%
	Nitrofurantoin	3,464	39%	67	84%	320	1%	30	0%	681	99%
	Norfloxacin	8	100%	--		--		--		--	
	Ofloxacin	--		--		--		--		--	
	Rifampin	--		--		3	100%	--		1,986	97%
	Tetracycline	1,187	86%	32	97%	10	60%	52	21%	2,239	81%
	Tobramycin	4,188	92%	190	98%	2,658	97%	315	81%	1	100%
	Trimethoprim	93	94%	8	100%	--		17	100%	--	
	TMP-SMX	5,336	87%	261	95%	796	2%	345	99%	1,535	53%
	Vancomycin	2	100%	--		9	89%	--		2,476	100%

AMC=amoxicillin/clavulanate

TMP-SMX=trimethoprim/sulfamethoxazole

Note that indeterminate results are included in this table. The percent susceptible is unreliable when less than 30 isolates are tested.