

UCLA

Health System

**Antimicrobial
Susceptibility
Summary
2026**

**Clinical Microbiology
Department of Pathology & Laboratory Medicine**

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The information contained in this booklet can also
be found at:

<https://asp.mednet.ucla.edu/pages/>

Select “Clinical Microbiology”
at the top of the homepage

Preface

This booklet contains up-to-date information to assist the clinician in making decisions concerning antimicrobial therapy and testing.

These tables summarize susceptibility data obtained for organisms isolated in the UCLA Clinical Microbiology Laboratory in 2025.

In order to provide the most meaningful information, the laboratory is selective in reporting antimicrobial susceptibility results.

Reporting guidelines are based on:

1. Identity of the organism
2. Body site of culture
3. Overall antibiogram of the organism
4. Therapeutically relevant antimicrobials
5. Formulary status of the antimicrobial

Non-formulary drugs are not routinely reported and controlled formulary agents are reported only in the appropriate setting: e.g. amikacin and tobramycin if resistant to gentamicin. Results of all relevant drugs tested, including those not reported, are available upon request.

We thank:

Daniel Uslan, MD, Chief Infection Prevention
Tara Vijayan, MD, Medical Director, Adult ASP
Ishminder Kaur, MD, Medical Director, Pediatric ASP
Kavitha Prabaker, MD, Hospital Epidemiologist SMH
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Allison Tsan, CLS, Sr. Specialist, Brentwood Annex
Stephanie Horiuchi, CLS, Sr. Specialist, Brentwood Annex

Guidelines for Interpretation of Minimal Inhibitory Concentrations (MICs)

MICs are interpreted as susceptible, susceptible dose dependent, intermediate, resistant, or non-susceptible according to Clinical and Laboratory Standards Institute (CLSI) M100, 36th edition guidelines. When deciding whether the interpretation is meaningful, one should consider the antimicrobial pharmacokinetics, taking into account dosage and route of administration, the infecting organism and site of infection, and previous clinical experience.

For antimicrobials without interpretive criteria consultation with Infectious Diseases strongly advised.

For additional information, please call the antimicrobial testing laboratory, or email the Antimicrobial Stewardship group.

Clinical Microbiology
UCLA Health System
Department of Pathology and Laboratory Medicine

Frequently called numbers*:

Antimicrobial Stewardship: antimicrobialstewardship@mednet.ucla.edu
Antimicrobial Testing Laboratory: 310-794-2760
Drug Information Center: 310-267-8522
Infection Prevention: Page 94040
Infectious Diseases Adult: 310-825-7225
Infectious Diseases Pediatric: 310-825-5235
RRMC and RNPH ID Pharmacist - Adult: 310-267-1423, page 71423
RRMC ID Pharmacist - Adult and Pediatric: 310-267-8510, page 92528
SMH ID Pharmacist - Adult: 310-267- 7567, page 91059
Microbiology Fellow on-call: page 90103

* If calling within UCLA system, dial the last 5 digits of the phone number.

Resources at UCLA through the Antimicrobial Stewardship Program (ASP)

The Antimicrobial Stewardship Program (ASP) has made resources available for the sole purpose of improving clinical outcomes of patients with infections. Questions and guidance on interpretation of culture reports (contaminant/pathogen), drug dosing, etc. are welcome. The ASP can be contacted numerous ways, depending on the urgency and clinical needs:

ASP Helpdesk/Consultation Email:

antimicrobialstewardship@mednet.ucla.edu

Website: <https://asp.mednet.ucla.edu/pages/>

We encourage you to reach out to the program with questions. The program is staffed by:

- Christine Pham, PharmD, BCIDP, ID Pharmacist
- Ethan Smith, PharmD, BCIDP, ID Pharmacist
- Lynn Chan, PharmD, BCIDP, ID Pharmacist
- Meganne Kanatani, PharmD, BCIDP, ID Pharmacist
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Glossary and Acronyms

—	Not routinely tested and/or not applicable
%R	Percent resistant
%S	Percent susceptible
Cipro R	Ciprofloxacin resistant
CP CRE	Carbapenemase producing carbapenem resistant Enterobacterales
CP CRPA	Carbapenemase producing carbapenem resistant Pseudomonas aeruginosa
CRE	Carbapenem Resistant Enterobacterales
CRPA	Carbapenem-Resistant Pseudomonas aeruginosa
I	Intermediate
ICU	Intensive care unit
IP	Inpatient (excludes intensive care unit and Emergency Department)
MDR	Multidrug resistant
Mero R	Meropenem resistant
MIC	Minimal inhibitory concentration µg/mL
MRSA	Methicillin resistant Staphylococcus aureus
MSSA	Methicillin susceptible Staphylococcus aureus
Non-CP CRE	Non-Carbapenemase producing carbapenem resistant Enterobacterales
OP	Outpatient (includes Emergency Department collections)
Pip-Tazo R	Piperacillin tazobactam resistant
R	Resistant, can be resistant due to intrinsic resistance
S	Susceptible
SDD	Susceptible dose dependent
spp.	Species
UTIs	Urinary tract infections
V	Variable
VRE	Vancomycin-resistant Enterococcus

Table 1. Adults (> 21 y.o.) Most Common Gram-negative Bacteria – Non-Urine Isolates, % Susceptible

Organism	Location	No. Isolates	Penicillin				Cephalosporins				Carbapenems			Aminoglycosides			Fluoro-quinolone		Other
			Ampicillin	Amoxicillin-Clavulanic acid	Ampicillin - sulbactam	Piperacillin - tazobactam ¹	Cefazolin	Cefepime ¹	Ceftazidime	Ceftriaxone	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Levofloxacin	Trimethoprim - sulfamethoxazole
<i>Enterobacter cloacae</i> complex ²	OP	91	R	R	R	92	R	99	— ³	— ³	99	100	100	100	100	100	97	98	96
	IP	102	R	R	R	69	R	99	— ³	— ³	90	99	100	99	95	95	91	91	85
	ICU	65	R	R	R	77	R	95	— ³	— ³	94	94	97	100	97	95	98	97	88
<i>Escherichia coli</i>	OP	452	—	69	—	94	56	88	82	77	100	100	100	97	85	83	65	68	62
	IP	506	—	66	—	95	47	78	71	66	99	100	99	95	81	79	58	61	59
	ICU	130	—	58	—	89	43	72	62	59	98	100	100	98	75	75	52	58	55
<i>Klebsiella pneumoniae</i>	OP	198	R	87	—	95	74	88	83	80	98	98	98	98	92	90	77	89	74
	IP	243	R	81	—	90	75	81	76	76	97	98	98	98	89	85	74	82	71
	ICU	132	R	67	—	81	55	73	68	67	94	94	94	92	83	72	68	78	68
<i>Proteus mirabilis</i>	OP	169	—	93	—	99	22	96	99	89	100	— ⁴	100	88	85	83	78	78	74
	IP	162	—	83	—	98	15	96	98	78	100	— ⁴	100	89	87	83	63	64	69
	ICU	29 ⁵	—	76	—	93	10	90	93	62	97	— ⁴	97	89	82	76	55	55	59
<i>Pseudomonas aeruginosa</i>	OP	533	R	R	R	89	R	92	92	R	R	89	92	— ⁶	— ⁶	92	81	78	R
	IP	446	R	R	R	81	R	90	85	R	R	82	85	— ⁶	— ⁶	93	80	73	R
	ICU	142	R	R	R	63	R	77	73	R	R	68	68	— ⁶	— ⁶	90	74	66	R

¹ %S includes %SDD

² *Enterobacter cloacae* complex includes *E. cloacae*, *E. asburiae*, and *E. hormaechei*.

³ 3rd generation cephalosporins should not be used for serious infections.

⁴ *Proteus* spp. may have elevated imipenem MIC by mechanisms other than production of carbapenemases.

⁵ Calculated from fewer than the standard recommendation of 30 isolates.

⁶ As of 2023, *Pseudomonas aeruginosa* breakpoints were revised, and tobramycin is now the only recommended aminoglycoside for systemic therapy. Amikacin is effective against *P. aeruginosa* only in urinary tract infections. Gentamicin is no longer recommended for *P. aeruginosa* infection at any site.

Table 2. Adults (> 21 y.o.) Gram-negative Bacteria – Non-Urine Isolates, % Susceptible

Organism	No. Isolates	Penicillin		Cephalosporins				Carbapenems			Aminoglycosides			Fluoro-quinolone		Other
		Amoxicillin-Clavulanic acid	Piperacillin-tazobactam	Cefazolin	Cefepime ¹	Ceftazidime	Ceftriaxone	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin	Levofloxacin	Trimethoprim sulfamethoxazole
<i>Citrobacter freundii</i> complex ²	103	R	80	R	96	— ³	— ³	97	99	99	99	94	93	89	90	89
<i>Klebsiella</i> (<i>Enterobacter</i>) <i>aerogenes</i>	100	R	85	R	98	— ³	— ³	96	95	98	99	99	99	93	96	98
<i>Enterobacter cloacae</i> complex ⁴	267	R	81	R	98	— ³	— ³	95	98	99	99	97	97	95	96	90
<i>Escherichia coli</i>	1072	68	94	52	82	76	71	99	99	99	96	82	81	61	64	60
<i>Klebsiella oxytoca</i>	206	93	96	12	97	95	91	99	99	99	98	94	93	91	97	89
<i>Klebsiella pneumoniae</i>	578	82	91	69	84	79	78	97	98	98	98	90	86	77	86	73
<i>Morganella morganii</i>	83	R	100	R	100	89	87	99	— ⁵	99	95	87	95	71	70	74
<i>Proteus mirabilis</i>	357	88	98	17	95	97	82	99	— ⁵	100	90	87	84	69	70	71
<i>Serratia marcescens</i>	226	R	97	R	100	98	88	99	95	100	95	97	88	89	94	99
<i>Acinetobacter baumannii</i> complex ⁶	80	R	43	R	55	49	—	—	56	55	74	63	71	56	60	68
<i>Pseudomonas aeruginosa</i>	1110	R	84	R	90	88	R	R	85	88	— ⁷	— ⁷	91	79	75	R
<i>Stenotrophomonas maltophilia</i> ⁸	111	R	—	R	—	—	R	R	R	R	R	R	R	—	54 ₉	97 ⁹
<i>Achromobacter</i> spp.	78	—	88	R	12	62	—	—	92	91	9	8	9	6	55	95

¹ %S includes %SDD

² *Citrobacter freundii* complex includes *C. freundii*, *C. youngae*, *C. braakii*, and *C. werkmanii*.

³ 3rd generation cephalosporins should not be used for serious infections.

⁴ *Enterobacter cloacae* complex includes *E. cloacae*, *E. asburiae*, and *E. hormaechei*.

⁵ *Proteus* spp. and *Morganella* spp. may have elevated imipenem MIC by mechanisms other than production of carbapenemases.

⁶ *Acinetobacter baumannii* complex includes *A. baumannii*, *A. calcoaceticus*, *A. pittii*, and *A. nosocomialis*.

⁷ As of 2023, *Pseudomonas aeruginosa* breakpoints were revised, and tobramycin is now the only recommended aminoglycoside for systemic therapy. Amikacin is effective against *P. aeruginosa* only in urinary tract infections. Gentamicin is no longer recommended for *P. aeruginosa* infection at any site.

⁸ *Stenotrophomonas maltophilia* minocycline %S = 85%

⁹ Levofloxacin and Trimethoprim sulfamethoxazole should not be used alone for antimicrobial therapy.

Table 3. Adults (> 21 y.o.) Gram-negative Bacteria – Urine Isolates, % Susceptible

Organism	Location	No. Isolates	Penicillin		Cephalosporin				Carbapenem			Amino-glycoside		Fluoro-quinolone		Other		
			Ampicillin	Amoxicillin – Clavulanic acid	Oral Cephalosporin ¹	Cefepime ²	Ceftazidime	Ceftriaxone	Ertapenem	Imipenem	Meropenem	Tobramycin	Amikacin	Ciprofloxacin	Levofloxacin	Nitrofurantoin	Trimethoprim/ sulfamethoxazole	Piperacillin/ Tazobactam ²
<i>Enterobacter cloacae</i> complex	OP	236	R	R	R	98	— ³	— ³	93	—	99	97	—	93	92	51	90	—
	IP	52	R	R	R	99	— ³	— ³	87	—	99	97	—	88	88	45	85	—
<i>Escherichia coli</i>	OP	9692	56	87	86	—	—	89	99	—	99	89	—	69	71	97	74	—
	IP	1094	39	80	71	—	—	74	99	—	99	77	—	54	55	96	64	—
<i>Klebsiella pneumoniae</i>	OP	1657	R	R	87	—	—	89	99	—	99	92	—	84	84	32	86	—
	IP	291	R	R	77	—	—	78	99	—	99	83	—	75	75	32	78	—
<i>Proteus mirabilis</i>	OP	944	82	97	94	—	—	96	99	—	99	94	—	88	88	R	82	—
	IP	189	72	93	78	—	—	82	99	—	99	76	—	70	69	R	72	—
<i>Pseudomonas aeruginosa</i>	OP	490	R	R	R	98	95	R	R	89	93	98	99 ⁴	89	84	R	R	94
	IP	143	R	R	R	89	85	R	R	86	88	95	98 ⁴	85	77	R	R	83

¹ Oral cephalosporins include cefpodoxime and cephalexin for treatment of uncomplicated urinary tract infections.

² %S includes %SDD

³ 3rd generation cephalosporin should not be used for serious infections.

⁴ As of 2023, *Pseudomonas aeruginosa* breakpoints were revised, and tobramycin is now the only recommended aminoglycoside for systemic therapy. Amikacin is effective against *P. aeruginosa* only in urinary tract infections. Gentamicin is no longer recommended for *P. aeruginosa* infection at any site.

Table 4. Adults (> 21 y.o.) Gram-positive Cocci, % Susceptible

Organism	Location	No. Isolates	Penicillins		Other									
			Oxacillin ¹	Penicillin	Ciprofloxacin	Clindamycin	Daptomycin	Tetracycline ²	Erythromycin	Linezolid	Rifampin ³	Trimethoprim sulfamethoxazole	Vancomycin	Ceftaroline
<i>Staphylococcus aureus</i>	OP	1886	76	24	78	72	99	85	55	99	99	95	99	99
	IP	830	64	20	70	67	99	81	48	99	99	95	99	99
	ICU	236	65	24	70	72	99	81	54	99	98	91	99	99
Oxacillin-resistant <i>S. aureus</i> (MRSA)	OP	460	R ¹	R ¹	35	69	99	61	19	99	99	88	99	99
	IP	614	R ¹	R ¹	31	64	99	64	19	99	99	89	99	99
	ICU	86	R ¹	R ¹	28	64	99	68	23	99	95	81	99	99
Oxacillin-susceptible <i>S. aureus</i> (MSSA)	OP	1410	99	34	93	74	99	97	68	99	99	96	99	99
	IP	343	99	31	91	72	99	99	66	99	99	95	99	99
	ICU	127	99	32	90	73	99	99	70	99	99	94	99	99

¹ *Staphylococcus* resistant to oxacillin are resistant to all other beta lactams except ceftaroline.

² Isolates that test susceptible to tetracycline are considered susceptible to doxycycline. Isolates that test intermediate or resistant to tetracycline may not be resistant to doxycycline. Isolate should be tested with doxycycline if results are needed for treatment.

³ Rifampin should not be used as monotherapy.

Table 4. Adults (> 21 y.o.) Gram-positive Cocci, % Susceptible (cont.)

Organism	Location	No. Isolates	Penicillins			Other											
			Ampicillin	Oxacillin	Penicillin	High Level Gentamicin ¹	Ciprofloxacin	Clindamycin	Daptomycin	Doxycycline	Tetracycline ²	Erythromycin	Linezolid	Rifampin ³	Trimethoprim sulfamethoxazole	Vancomycin	Ceftaroline
<i>Staphylococcus epidermidis</i>	All	612	—	46	10	—	65	64	99	—	78	38	99	98	63	99	—
<i>Staphylococcus haemolyticus</i>	All	86	—	38	28	—	52	48	99	—	64	29	99	84	62	99	—
<i>Staphylococcus lugdunensis</i> ⁴	All	419	—	87	37	—	99	85	99	—	91	79	99	99	99	99	—
<i>Staphylococcus pseudintermedius/ intermedius</i>	All	83	—	71	8	—	67	65	99	—	52	52	99	99	58	99	—
Coagulase negative <i>Staphylococcus</i> ^{5,6}	All	139	—	66	32	—	80	80	99	—	84	53	99	99	91	99	—
<i>Enterococcus</i> spp. ^{7 8}	All	48	88	—	—	— ⁹	71	R	79	63	—	63	99	46	R	58	R
Enterococcus faecalis ⁷	All	683	99	—	—	82 ¹⁰	55	R	90	35	—	R	99	21	R	96	R
Enterococcus faecium ⁷	All	223	15	—	—	91 ¹⁰	8	R	87	39	—	R	99	7	R	40	R

¹ High level gentamicin 500µg/mL.

² Isolates that test susceptible to tetracycline are considered susceptible to doxycycline. Isolates that test intermediate or resistant to tetracycline may not be resistant to doxycycline. Isolate should be tested with doxycycline if results are needed for treatment.

³ Rifampin should not be used as monotherapy.

⁴ *S. lugdunensis* is best treated with a Beta-lactam agent.

⁵ *S. saprophyticus* urinary tract infections respond to antibiotic concentrations achieved in urine with agents commonly used to treat acute uncomplicated UTIs.

⁶ Excluding *S. epidermidis*, *S. lugdunensis* and *S. pseudintermedius*.

⁷ Serious Enterococcal infections need combination therapy of ampicillin plus ceftriaxone or an aminoglycoside.

⁸ Enterococcus spp. excludes *E. faecalis* and *E. faecium*.

⁹ Insufficient data to calculate % susceptible.

¹⁰ % susceptible calculated with isolates tested from sterile body sites. *E. faecalis* n=99 and *E. faecium* n=91.

Table 4. Adults (> 21 y.o.) Gram-positive Cocci, % Susceptible (cont.)

Organism	No. Isolates	Penicillins		Cephalosporins			Other					
		Amoxicillin	Penicillin	Cefotaxime	Ceftriaxone		Doxycycline	Erythromycin	Levofloxacin	Trimethoprim – sulfamethoxazole	Tetracycline	Vancomycin
<i>Streptococcus pneumoniae</i>	51	86	—	—	—	80	73	60	100	75	—	100
Meningitis ¹		—	59	75	73	—	—	—	—	—	—	—
Non-meningitis ²		—	90	88	88	—	—	—	—	—	—	—
Viridans group <i>Streptococcus</i> spp. ³	102	—	55 ⁴	98	98	—	—	—	—	—	—	100
<i>Streptococcus anginosus</i> group	74	—	99	100	100	—	—	—	—	—	—	100
<i>Streptococcus agalactiae</i> (Group B streptococci)	119	—	100	—	—	41	—	—	—	—	—	100
<i>Streptococcus pyogenes</i> (Group A streptococci)	21 ⁵	—	100	—	—	85	—	81	—	86 ⁶	71	100

¹ % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients with meningitis.

² % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients without meningitis.

³ Excluding *Streptococcus anginosus* group.

⁴ 42.5% Intermediate (MIC 0.25-2 µg/ml).

⁵ Calculated from fewer than the standard recommendation of 30 isolates.

⁶ Limited to skin and skin structure infections; not indicated for isolates from other sources (e.g. pharyngeal)

Table 5. Miscellaneous Gram-negative Bacteria

Organism	No. Isolates	% beta-lactamase positive ¹
<i>Haemophilus influenzae</i>	143 (pts. >21 y.o) 19 (pts. ≤21 y.o.)	25 21
<i>Moraxella catarrhalis</i>	56 (pts. >21 y.o) 10 (pts. ≤21 y.o.)	96 100
<i>Neisseria gonorrhoeae</i>	The current therapy recommendation is ceftriaxone. Culture and susceptibility testing should be performed in cases of treatment failure. See https://www.cdc.gov/gonorrhea/about/index.html PER STD 2021 treatment guidelines, the recommended treatment for gonorrhea is ceftriaxone 500 mg IM x 1 for patients <150 kg, 1g for patients ≥ 150 kg. Doxycycline 100mg twice daily for 7 days is recommended if there is suspicion or confirmed Chlamydia co-infection	
<i>Neisseria meningitidis</i>	The current therapy recommendation is ceftriaxone for treating meningococcal infections. Penicillin may be considered after susceptibilities return and MIC is ≤0.12 µg/mL (Antimicrob Agents Chemother 56:2268, 2012). CDPH no longer recommends ciprofloxacin for post-exposure prophylaxis due to resistance. Ref: https://www.cdph.ca.gov/Programs/OPA/Pages/CAHAN/ca-discontinuation-of-ciprofloxacin-for-invasive-meningococcal-disease-pep.aspx. Sanford guide 2025 Recommended: Ceftriaxone Alternative: Meropenem	

¹ Resistant to ampicillin, amoxicillin, and penicillin.

Table 6. Multiple Drug Resistant Enterobacterales – All sources % Susceptible

	Amikacin		Aztreonam		Ceftazidime-Avibactam ¹		Ceftolozane-Tazobactam ¹		Tigecycline ²		Meropenem-Vaborbactam ¹		Eravacycline ^{1, 2, 3}		Omadacycline ^{2, 4}	
Organism	Number of isolates tested	% Susceptible	Number of isolates tested	% Susceptible	Number of isolates tested	% Susceptible	Number of isolates tested	% Susceptible	Number of isolates tested	% Susceptible	Number of isolates tested	% Susceptible	Number of isolates tested	% Susceptible	Number of isolates tested	% Susceptible
Carbapenem Resistant Enterobacterales (CRE)	349	83	67	6	349	94	349	77	70	87	66	77	66	79	66	80

¹Restricted formulary. ID consult required.

² Interpretations are based on FDA breakpoints. There are no current CLSI breakpoints available for these drugs. Please refer to the FDA website at: <https://www.fda.gov/drugs/development-resources/antibacterial-susceptibility-test-interpretive-criteria>.

³ FDA guidelines indicated that clinical efficacy was shown for *Citrobacter freundii*, *Enterobacter cloacae*, *Escherichia coli*, *Klebsiella oxytoca* & *Klebsiella pneumoniae*.

⁴ FDA breakpoint for Omadacycline applies to *Klebsiella pneumoniae* only and indicated for Community Acquired Bacterial Pneumonia (CABP) and Acute Bacterial Skin/Skin Structure Infections (ABSSI).

Table 7. Multiple Drug Resistant Gram-negative Bacteria, Other – All sources % Susceptible

Organism	Number of Isolates	Amikacin	Gentamicin	Ciprofloxacin	Piperacillin-Tazobactam	Cefepime	Ceftazidime	Ceftazidime-Avibactam ¹	Ceftolozane-Tazobactam ¹	Minocycline ¹	Trimethoprim-sulfamethoxazole
<i>Pseudomonas aeruginosa</i> , Imipenem <u>or</u> Meropenem resistant	292	91 ²	—	50	49	63	59	90	91	R	R
<i>Pseudomonas aeruginosa</i> , Imipenem <u>and</u> Meropenem resistant	171	89 ²	—	38	29	47	41	87	89	R	R
<i>Acinetobacter baumannii</i> complex ³ , Meropenem resistant	42	43 ²	21	10	2	2	5	—	—	50	36

¹ Restricted formulary. ID consult required.

² Amikacin for *Pseudomonas aeruginosa* is for Urine isolates only.

³ *Acinetobacter baumannii* complex includes *A. baumannii*, *A. calcoaceticus*, *A. pittii* and *A. nosocomialis*.

Table 8. Pediatrics (≤ 21 y.o.) Gram-negative Bacteria – Non-Urine Isolates, % Susceptible

Organism	No. Isolates	Penicillins				Cephalosporins				Carbapenems			Aminoglycosides			Fluoroquinolone	Other
		Ampicillin ¹	Amoxicillin-Clavulanic acid	Ampicillin-sulbactam ¹	Piperacillin-tazobactam	Cefazolin	Cefepime	Ceftazidime	Ceftriaxone ²	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin ³	Trimethoprim – sulfamethoxazole
<i>Enterobacter cloacae</i> complex ⁴	29 ⁵	R	R	R	90	R	97	— ⁶	— ⁵	99	97	99	99	97	97	93	96
<i>Escherichia coli</i>	68	—	76	—	94	78	90	88	81	99	99	99	97	88	87	72	66
<i>Klebsiella pneumoniae</i>	42	R	76	—	90	74	90	86	81	95	99	99	99	81	81	79	81
<i>Serratia marcescens</i>	35	R	R	R	99	R	99	99 ⁶	94 ⁶	99	97	99	97	99	91	91	97
<i>Pseudomonas aeruginosa</i>	94	R	R	R	93	R	95	94	R	R	86	90	— ⁷	— ⁷	96	89	R

¹ Ampicillin and Ampicillin-sulbactam testing were discontinued on July 26, 2016.

² Ceftriaxone and cefotaxime have comparable activity against *Enterobacteriaceae*.

³ Ciprofloxacin is associated with arthropathy and histological changes in weight-bearing joints of juvenile animals and should only be used when no safe and effective alternatives exist.

⁴ *Enterobacter cloacae* complex includes *E. cloacae*, *E. asburiae*, and *E. hormaechei*.

⁵ Calculated from fewer than the standard recommendation of 30 isolates.

⁶ 3rd generation cephalosporins should not be used for serious infections.

⁷ As of 2023, *Pseudomonas aeruginosa* breakpoints were revised, and tobramycin is now the only recommended aminoglycoside for systemic therapy. Amikacin is effective against *P. aeruginosa* only in urinary tract infections. Gentamicin is no longer recommended for *P. aeruginosa* infection at any site.

Table 9. Pediatrics (≤ 21 y.o.) Gram-negative Bacteria – Urine Isolates, % Susceptible

Organism	No. Isolates	Penicillins		Cephalosporins				Carbapenems			Amino-glycosides			Fluoroquinolone	Other	
		Ampicillin	Amoxicillin - Clavulanic acid	Oral Cephalosporins ¹	Cefepime	Ceftazidime	Ceftioxone	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin ²	Trimethoprim – sulfamethoxazole	Nitrofurantoin
<i>Enterobacter cloacae</i> complex ³	24 ⁴	R	R	R	99	—	—	91	—	99	—	—	96	92	83	21
<i>Escherichia coli</i>	904	56	88	91	—	—	93	99	—	99	—	—	92	77	78	98
<i>Klebsiella pneumoniae</i>	95	R	91	87	—	—	88	99	—	99	—	—	88	82	76	25
<i>Proteus mirabilis</i>	123	90	96	99	—	—	99	99	— ⁵	99	—	—	98	97	87	R
<i>Pseudomonas aeruginosa</i>	14 ⁴	R	R	R	99	99	R	R	—	99	99 ⁶	— ⁶	99 ⁶	93	R	R

¹ Oral Cephalosporins include Cefpodoxime and Cephalexin for treatment of uncomplicated urinary tract infections.

² Ciprofloxacin is associated with arthropathy and histological changes in weight-bearing joints of juvenile animals and should only be used when no safe and effective alternatives exist.

³ *Enterobacter cloacae* complex includes *E. cloacae*, *E. asburiae*, and *E. hormaechei*.

⁴ Calculated from fewer than the standard recommendation of 30 isolates.

⁵ *Proteus* spp. may have elevated imipenem MIC by mechanisms other than production of carbapenemases.

⁶ As of 2023, *Pseudomonas aeruginosa* breakpoints were revised, and tobramycin is now the only recommended aminoglycoside for systemic therapy. Amikacin is effective against *P. aeruginosa* only in urinary tract infections. Gentamicin is no longer recommended for *P. aeruginosa* infection at any site.

Table 10. Pediatrics (≤ 21 y.o.) Gram-positive Cocci, % Susceptible

Organism	Location	No. Isolates	Penicillins			Cephalosporins		Others										
			Ampicillin	Oxacillin	Penicillin	Ceftriaxone	Cefotaxime	Ciprofloxacin ¹	Clindamycin	Daptomycin	Doxycycline	Tetracycline ²	Erythromycin	Linezolid	Rifampin ³	Trimethoprim-sulfamethoxazole	Vancomycin	Ceftaroline
<i>Staphylococcus aureus</i> (All)	OP	538	—	88	25	—	—	91	81	99	—	89	68	99	99	96	99	99
	IP	113	—	87	25	—	—	92	75	99	—	95	66	99	99	97	99	99
Oxacillin-resistant <i>S. aureus</i> (MRSA) ³	OP	63	—	R ⁴	R ⁴	R ⁴	R ⁴	56	81	99	—	68	32	99	99	89	99	99
	IP	15 ⁵	—	R ⁴	R ⁴	R ⁴	R ⁴	53	80	99	—	86	33	99	99	80	99	99
Oxacillin-susceptible <i>S. aureus</i> (MSSA)	OP	477	—	99	28	—	—	96	80	99	—	92	72	99	99	97	99	99
	IP	99	—	99	28	—	—	97	75	99	—	96	72	99	99	99	99	99

¹ Ciprofloxacin is associated with arthropathy and histological changes in weight bearing joints of juvenile animals and should only be used when no safe and effective alternatives exist.

² Isolates that test susceptible to tetracycline are considered susceptible to doxycycline. Isolates that test intermediate or resistant to tetracycline may not be resistant to doxycycline. Isolate should be tested with doxycycline if results are needed for treatment.

³ Rifampin should not be used as monotherapy.

⁴ *Staphylococcus* resistant to oxacillin are resistant to cefazolin, cephalixin, ceftriaxone and all other beta-lactams except ceftaroline.

⁵ Calculated from fewer than the standard recommendation of 30 isolates.

Table 10. Pediatrics (≤ 21 y.o.) Gram-positive Cocci, % Susceptible (cont.)

Organism	Location	No. Isolates	Penicillins			Cephalosporins		Others											
			Ampicillin	Oxacillin	Penicillin	Ceftriaxone	Cefotaxime	High Level Gentamicin ¹	Ciprofloxacin ²	Clindamycin	Daptomycin	Doxycycline	Tetracycline ³	Erythromycin	Linezolid	Rifampin ⁴	Trimethoprim-sulfamethoxazole	Vancomycin	Ceftaroline
Coagulase negative <i>Staphylococcus</i> ⁵	ALL	37	—	67	32	—	—	—	97	73	99	—	77	46	99	99	86	99	—
	OP	18 ⁶	—	78	50	—	—	—	99	78	99	—	93	67	99	99	99	99	—
	IP	19 ⁶	—	56	16	—	—	—	95	68	99	—	55	26	99	99	74	99	—
<i>Staphylococcus epidermidis</i>	All	70	—	40	13	—	—	—	73	61	99	—	85	34	99	99	70	99	—
<i>Staphylococcus lugdunensis</i>	All	49	—	98	32	—	—	—	98	86	99	—	94	88	99	99	99	99	—
<i>Enterococcus faecalis</i>	All	43	99	—	—	R	R	74	70	R	93	30	—	R	99	16	R	99	—
<i>Enterococcus faecium</i>	All	5 ⁶	20	—	—	R	R	99	20	R	99	60	—	R	99	20	R	60	—

¹ High level Gentamicin 500 µg/ml.

² Ciprofloxacin is associated with arthropathy and histological changes in weight bearing joints of juvenile animals and should only be used when no safe and effective alternatives exist.

³ Isolates that test susceptible to tetracycline are considered susceptible to doxycycline. Isolates that test intermediate or resistant to tetracycline may not be resistant to doxycycline. Isolate should be tested with doxycycline if results are needed for treatment.

⁴ Rifampin should not be used as monotherapy.

⁵ *Staphylococcus* other than *S. aureus* (SOSA), excludes *S. epidermidis* and *S. lugdunensis*.

⁶ Calculated from fewer than the standard recommendation of 30 isolates.

Table 10. Pediatrics (≤ 21 y.o.) Gram-positive Cocci, % Susceptible (cont.)

Organism	No. Isolates	Penicillins		Cephalosporins		Other				
		Amoxicillin	Penicillin	Cefotaxime	Ceftriaxone	Clindamycin	Doxycycline	Erythromycin	Trimethoprim – sulfamethoxazole	Vancomycin
<i>Viridans group Streptococcus</i>	25 ¹	—	44	88	88	—	—	—	—	99
<i>Streptococcus anginosus</i>	5 ¹	—	99	99	99	—	—	—	—	99
<i>Streptococcus pneumoniae</i>	5 ¹	99	—	—	—	99	80	80	80	99
Meningitis ²		—	40	99	99	—	—	—	—	—
Non-meningitis ³		—	99	99	99	—	—	—	—	—

¹ Calculated from fewer than the standard recommendation of 30 isolates.

² % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients with meningitis.

³ % susceptible for penicillin, cefotaxime and ceftriaxone applies to patients without meningitis.

Table 11. Yeasts, %S, %I, %SDD, %R, 2024-2025

- Most yeast infections can be treated empirically. Antifungal testing of yeasts may be warranted for the following:
 - Oropharyngeal or vaginal infections due to *Candida* spp. in patients who appear to be failing therapy.
 - Management of invasive *Candida* spp. infections when utility of an azole agent is uncertain (e.g., *Candida* spp. other than *C. albicans*), per IDSA guidelines for candidiasis: CID 2016:62, E1-E50. Clinical Practice Guidelines for the Management of Candidiasis.
- Isolation of *Candida* in respiratory specimens of immunocompetent patients should be interpreted as airway colonization.

Organism	N	Percent Susceptible, Susceptible Dose Dependent, Intermediate, Resistant at Breakpoints ^{1, 2, 3}														
		Fluconazole ⁴			Voriconazole ⁴			Caspofungin ⁴			Micafungin ⁴			Anidulafungin ⁴		
		S	SDD	R	S	I	R	S	I	R	S	I	R	S	I	R
<i>Candida albicans</i>	344	≤ 2	4	≥ 8	≤ 0.12	0.25-0.5	≥ 1	≤ 0.25	0.5	≥ 1	≤ 0.25	0.5	≥ 1	≤ 0.25	0.5	≥ 1
		96	0	4	83	16	1	99	0	0	99	0	0	99	0	0
<i>Candida glabrata</i>	207	—	≤ 32	≥ 64	— ⁵	— ⁵	— ⁵	≤ 0.12	0.25	≥ 0.5	≤ 0.06	0.12	≥ 0.25	≤ 0.12	0.25	≥ 0.5
		—	87	13	— ⁵	— ⁵	— ⁵	96	4	0	99	1	0	99	1	0
<i>Candida parapsilosis</i>	86	≤ 2	4	≥ 8	≤ 0.12	0.25-0.5	≥ 1	≤ 2	4	≥ 8	≤ 2	4	≥ 8	≤ 2	4	≥ 8
		95	0	5	94	3	2	99	0	0	99	0	0	99	1	0
<i>Candida tropicalis</i>	57	≤ 2	4	≥ 8	≤ 0.12	0.25-0.5	≥ 1	≤ 0.25	0.5	≥ 1	≤ 0.25	0.5	≥ 1	≤ 0.25	0.5	≥ 1
		96	0	4	93	2	5	99	0	0	99	0	0	99	0	0
<i>Candida krusei</i>	34	—	—	—	≤ 0.5	1	≥ 2	≤ 0.25	0.5	≥ 1	≤ 0.25	0.5	≥ 1	≤ 0.25	0.5	≥ 1
		R	R	R	97	3	0	91	9	0	99	0	0	99	0	0
<i>Candida guilliermondii</i>	10 ⁶	—	—	—	—	—	—	≤ 2	4	≥ 8	≤ 2	4	≥ 8	≤ 2	4	≥ 8
		—	—	—	—	—	—	99	0	0	99	0	0	99	0	0

¹ CLSI. Reference Method for Broth Dilution Antifungal Susceptibility Testing of Yeast. 4th ed. CLSI Standard M27. Wayne, PA.: Clinical and Laboratory Standards Institute; 2017

² CLSI. Performance Standards for Antifungal Susceptibility Testing of Yeasts. 2nd ed. CLSI Standard M27. Wayne, PA.: Clinical and Laboratory Standards Institute; 2017

³ Breakpoint MIC in mg/ml

⁴ Not all isolates were tested against all four antifungal agents.

⁵ For *C. glabrata* and voriconazole, current data are insufficient to demonstrate correlation between *in vitro* susceptibility testing and clinical outcome.

⁶ Calculated from fewer than the standard recommendation of 30 isolates.

Table 12. Candida Resistance

When specific antimicrobial resistance (R) is detected, an Infectious Disease (ID) consult is strongly suggested.

Organism	If Resistant to:	Therapeutic Options	Comments
<i>Candida krusei</i>	micafungin	voriconazole ¹ amphotericin ²	Typically susceptible to micafungin. Breakthrough infections have been reported. ³
	voriconazole	micafungin ⁴ amphotericin ^{2, 5}	Intrinsically resistant to fluconazole ^{6, 7} Typically susceptible to voriconazole ^{6, 7}
<i>Candida glabrata</i>	micafungin	fluconazole ⁸ voriconazole ¹ amphotericin ^{2, 5}	echinocandin resistance may be emerging. ⁶
	fluconazole	voriconazole ¹ micafungin ⁴ amphotericin ^{2, 5}	Typically resistant to fluconazole. ^{6, 7}
<i>Candida albicans</i>	micafungin	fluconazole ⁸ amphotericin ^{2, 5}	Typically susceptible to micafungin. ^{6, 7}
	fluconazole	micafungin ⁴ amphotericin ^{2, 5}	Typically susceptible to fluconazole but resistance can develop during therapy. ^{6, 7}
<i>Candida auris</i>	Often resistant to azoles, amphotericin and some are echinocandin resistant	Infectious Disease consult is strongly suggested	<i>Candida auris</i> is an emerging multi-drug resistant organism, able to cause wide range of infections.

These are therapeutic options in adults. For therapeutic options in pediatric patients, please contact the Antimicrobial Stewardship.

¹ Voriconazole has poor penetration in urine.

² Liposomal amphotericin has poor penetration in urine.

³ Tavernier, E., et al. Development of echinocandin resistance in *Candida krusei* isolates following exposure to micafungin and caspofungin in a BM transplant unit. Bone Marrow Transplant 50, 158–160 (2015)

⁴ micafungin may not reach therapeutic concentration in the CSF, vitreous fluid or urine.

⁵ Among patients without baseline renal dysfunction and suspected azole- and echinocandin-resistant *Candida* infections, liposomal amphotericin B is recommended. Infectious Disease consult is highly recommended.

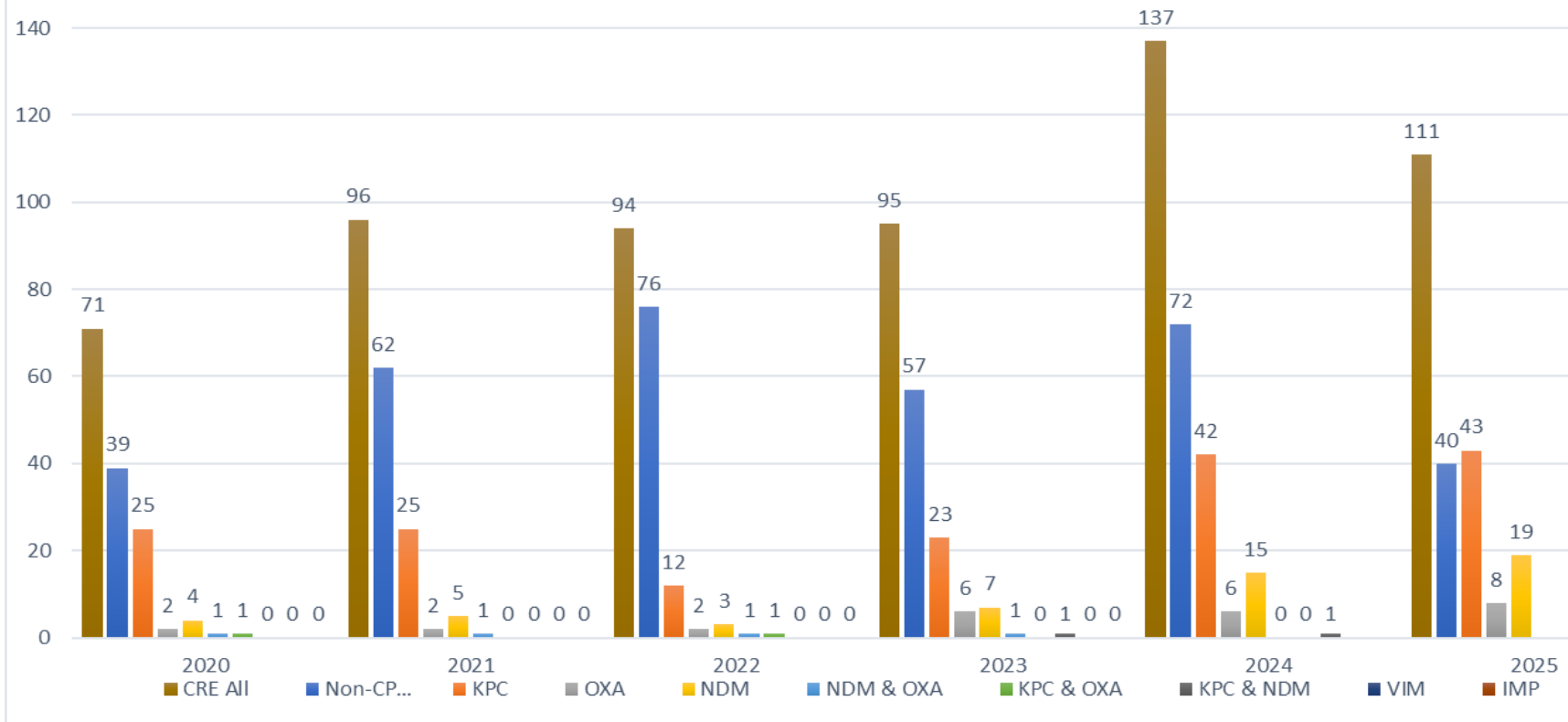
⁶ Pappas, P. G., et al. (2016). Clinical Practice Guideline for the Management of Candidiasis: 2016 Update by the Infectious Diseases Society of America. Clinical infectious diseases: an official publication of the Infectious Diseases Society of America, 62(4), e1–e50.

⁷ Treatment Guidelines from the Med. Letter-Antifungal Drugs. 2012;10(120);61-68

⁸ For initial treatment with fluconazole, careful consideration should be given, especially in critically ill patients or those with prior azole exposure or prophylaxis. Infectious Disease consult is highly recommended.

Table 13. Carbapenem-resistant Enterobacterales (CRE), 2020-2025

Year	CRE All	CPE	Non-CP CRE	KPC	OXA	NDM	KPC & NDM	NDM & OXA	KPC & OXA	VIM	IMP
2020	71	32	39	25	2	4	0	0	1	0	0
2021	96	34	62	25	2	5	0	1	1	0	0
2022	94	18	76	12	2	3	0	1	0	0	0
2023	95	38	57	23	6	7	0	1	1	0	0
2024 ¹	137	65	72	42	6	15	1	1	0	0	0
2025 ¹	111	71	40	43	8	19	1	0	0	0	0



¹ Includes CPE Surveillance Cultures results

Table 13. Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA), 2023-2025 (Cont.)

Year	Non-CP CRPA	CP CRPA	KPC	OXA	NDM	VIM	IMP
2023	114	7	0	2	5	0	0
2024	137	3	0	0	2	1	0
2025	175	2	1	0	0	1	0

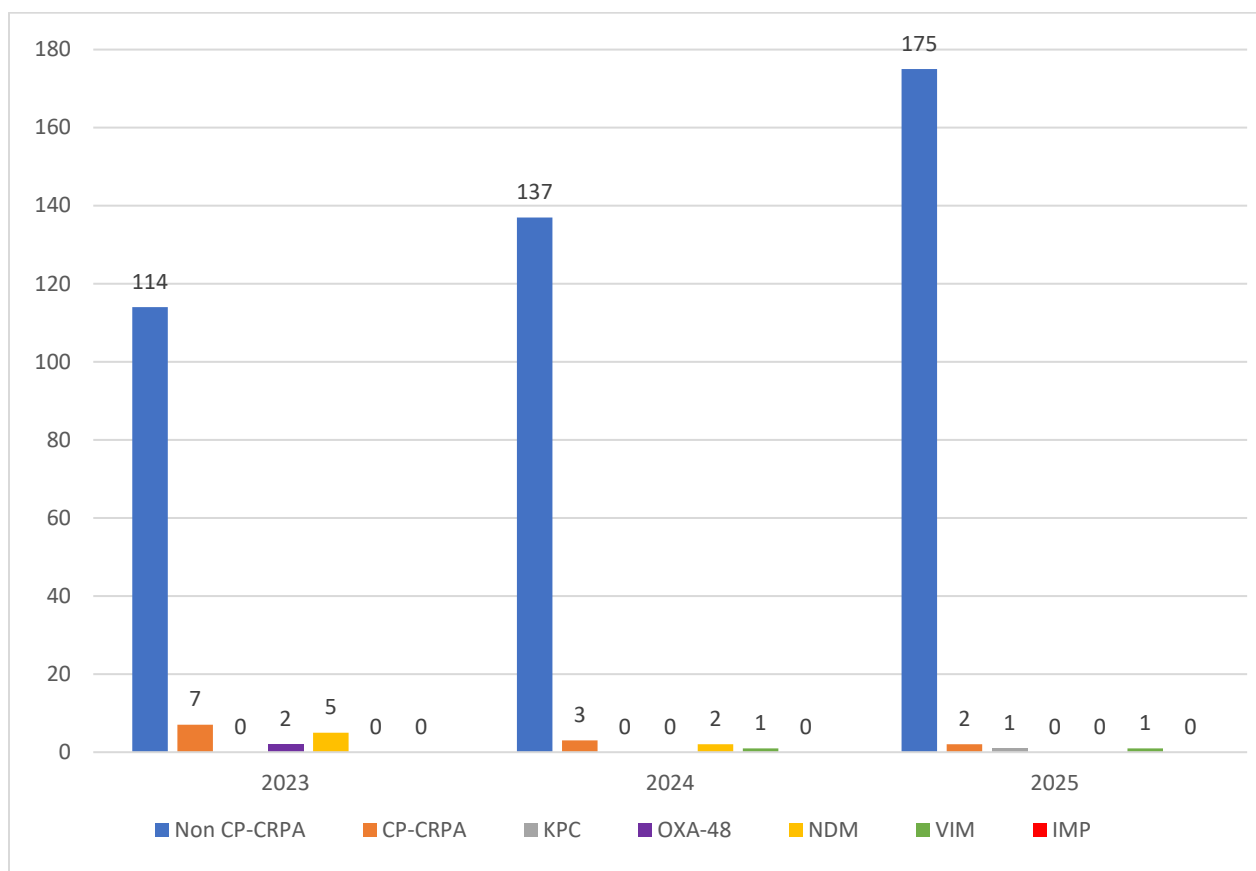


Table 14. Treatment Suggestions for Organisms for which Susceptibility Testing is not Routinely Performed

Organism	Recommended	Alternate treatment	Comments / Also Effective
<i>Aerococcus urinae</i>	Amoxicillin	Levofloxacin or Ciprofloxacin	Fluoroquinolones resistant strains (27%-33%) have been reported. ¹
<i>Bordetella pertussis</i> ²	Azithromycin or Clarithromycin	Trimethoprim-sulfamethoxazole	
<i>Burkholderia cepacia</i> complex	Routine susceptibility testing is not recommended, as MIC values do not correlate with clinical outcomes. If susceptibility information is needed for patient management, please contact the microbiology laboratory and consider infectious disease consultation.		
<i>Campylobacter jejuni</i> ²	Azithromycin	Consult with ID	Trimethoprim-sulfamethoxazole, Penicillin & Cephalosporins <u>NOT Active</u>
<i>Campylobacter fetus</i> ²	Gentamicin	Imipenem or Ceftriaxone	Ampicillin
<i>Legionella</i> spp. ²	Levofloxacin or Azithromycin	Moxifloxacin or doxycycline	
<i>Mycoplasma pneumoniae</i> ²	Adult Patients: Doxycycline Pediatric Patients: Azithromycin	Adult Patients: Azithromycin, Minocycline Pediatric Patients: Doxycycline	Clindamycin & B-lactams <u>NOT Effective</u> . Increasing macrolide resistance.
<i>Mycoplasma hominis</i>	Consult with ID	Consult with ID	<u>Resistant</u> to Erythromycin and azithromycin. Fluoroquinolone and Tetracycline resistant strains have been reported. ³

¹ Berteau, T., Roy, F. É., Bestman-Smith, J., Lapierre, S. G., Longtin, J., Dufresne, S. F., ... & Leduc, J. M. (2018, November). 2001. Susceptibility of *Aerococcus urinae* to Fluoroquinolones: Broth Microdilution and Gradient Diffusion. In Open Forum Infectious Diseases (Vol. 5, No. suppl_1, pp. S582-S583). US: Oxford University Press.

² The Sanford Guide to Antimicrobial Therapy. (2020). Sperryville, VA: Antimicrobial Therapy, Inc.

³ Waites, K. B., Katz, B., & Schelonka, R. L. (2005). Mycoplasmas and Ureaplasma as neonatal pathogens. Clinical microbiology reviews, 18(4), 757–789.

Table 14. Treatment Suggestions for Organisms for which Susceptibility Testing is not Routinely Performed (cont.)

Organism	Recommended	Alternate treatment	Comments / Also Effective
<i>Stenotrophomonas maltophilia</i> ^{4 5}	Consult with ID	Consult with ID	Fluoroquinolone For moderate to severe infections, ID consultation should be considered.
<i>Streptococcus agalactiae</i> (Group B <i>Streptococcus</i>)	Penicillin, Ampicillin, or Amoxicillin	Cefazolin or Vancomycin	
<i>Cutibacterium</i> (<i>Propionibacterium</i>) <i>acnes</i> ²	Penicillin, Ceftriaxone	Vancomycin, Daptomycin, Linezolid 	Resistant to Metronidazole
<i>Ureaplasma</i>	Azithromycin, Doxycycline		Resistant to Clindamycin. Tetracycline resistant strains have been reported. ³

⁴ Susceptibility performed on *Stenotrophomonas maltophilia* isolates from sterile body sites and Cystic Fibrosis cases.

⁵ Tamma P, Heil EL, Justo JA, Mathers AJ, Satlin MJ, Bonomo RA. IDSA Antimicrobial-Resistant Treatment Guidance: Gram-Negative Bacterial Infections. IDSA 2024. Version 4.0

Table 15. Blood: One Isolate per Patient (All), 2025

Blood Culture Organisms (ALL)	n	% of Total Blood Isolates
Gram-negative, Enterobacterales	726	27.0%
Gram-negative, non-Enterobacterales	110	4.1%
Gram-positive, Staphylococcus species	912	34.0%
Gram-positive, Other	618	23.0%
Anaerobe	132	4.9%
Fungi	143	5.3%
Mycobacteria	7	0.3%

*Excludes

Coagulase-negative *Staphylococcus* (n= 892)

Viridans group *Streptococcus* (n=128)

Corynebacterium spp. (n= 52)

Bacillus spp. (n=34)

Micrococcus spp. (n= 31)

Cutibacterium (Propionibacterium) acnes (n=15)

Aerococcus viridans (n=6)

Most Common Organism*	n	% of Total Blood Isolates
<i>Escherichia coli</i> , 31% ceftriaxone R	464	26.2%
<i>Staphylococcus aureus</i> , 38% MRSA	282	15.9%
<i>Enterococcus</i> species, 27% VRE	260	14.7%
<i>Klebsiella pneumoniae</i> , 27% ceftriaxone R	169	9.5%
<i>Pseudomonas aeruginosa</i>	89	5.0%
<i>Proteus mirabilis</i>	66	3.7%
<i>Candida glabrata</i>	54	3.0%
<i>Bacteroides</i> species	47	2.7%
<i>Enterobacter cloacae</i> complex	41	2.3%
Other Enterobacteriaceae spp.	33	1.9%
<i>Candida albicans</i>	28	1.6%
<i>Streptococcus anginosus</i> group	24	1.4%
<i>Streptococcus pneumoniae</i>	23	1.3%
<i>Klebsiella oxytoca</i>	22	1.2%
<i>Serratia marcescens</i>	22	1.2%
<i>Streptococcus agalactiae</i>	20	1.1%
<i>Acinetobacter</i> species	19	1.1%
<i>Candida parapsilosis</i>	18	1.0%
<i>Stenotrophomonas maltophilia</i>	16	0.9%
<i>Citrobacter freundii</i> complex	15	0.8%
<i>Candida auris</i>	14	0.8%
<i>Streptococcus pyogenes</i>	13	0.7%
<i>Morganella morganii</i>	13	0.7%
<i>Candida tropicalis</i>	11	0.6%
<i>Klebsiella aerogenes</i>	8	0.5%

Table 15. Blood: One Isolate per Patient (ALL), 2025 (cont.)

Gram-positive Bacterial Isolates*	n	% of Gram-positive Isolates	Fungal Isolates	n	% of Fungal Isolates
<i>Staphylococcus aureus</i> , 38% MRSA	282	33.3%	<i>Candida albicans</i>	28	20%
<i>Enterococcus spp.</i> , 27% VRE	260	30.7%	<i>Candida glabrata</i>	28	20%
Viridans group <i>Streptococcus</i>	128	15.1%	<i>Candida auris</i>	21	15%
Other Gram-Positive	59	7.0%	<i>Candida parapsilosis</i>	14	10%
<i>Streptococcus anginosus</i> group	24	2.8%	<i>Candida tropicalis</i>	11	8%
<i>Streptococcus pneumoniae</i>	23	2.7%	<i>Candida krusei</i>	6	4%
<i>Streptococcus agalactiae</i>	20	2.4%	<i>Cryptococcus neoformans</i>	5	4%
<i>Beta Streptococcus</i>	17	2.0%	<i>Candida lusitanae</i>	3	2%
<i>Rothia species</i>	16	1.9%	<i>Other Fungi</i>	26	18%
<i>Streptococcus pyogenes</i>	13	1.5%	Total	142	
<i>Arcanobacterium haemolyticum</i>	2	0.2%			
<i>Listeria monocytogenes</i>	2	0.2%			
Total	846				
Excludes other coagulase – negative <i>Staphylococcus</i> , <i>Corynebacterium</i> spp., <i>Bacillus</i> spp., <i>Micrococcus</i> spp.			Anaerobic Bacterial Isolates	n	% of Anaerobic Bacterial Isolates
Gram-negative Bacterial Isolates	n	% of Gram-negative Isolates	<i>Bacteroides species</i>	32	24%
<i>Escherichia coli</i> , 31% ceftriaxone R	464	45%	<i>Lactobacillus species</i>	15	11%
<i>Klebsiella pneumoniae</i> , 27% ceftriaxone R	169	16%	<i>Clostridium species</i>	9	7%
<i>Pseudomonas aeruginosa</i>	89	9%	<i>Gemella species</i>	8	6%
<i>Proteus mirabilis</i>	66	6%	<i>Fusobacterium species</i>	6	5%
Other gram-negatives	58	6%	<i>Staphylococcus saccharolyticus</i>	5	4%
<i>Enterobacter cloacae</i> complex	41	4%	<i>Actinomyces species</i>	5	4%
Other <i>Enterobacteriaceae</i> spp.	29	3%	<i>Bifidobacterium species</i>	4	3%
<i>Klebsiella oxytoca</i>	22	2%	<i>Other anaerobe</i>	49	37%
<i>Serratia marcescens</i>	22	2%	*Excludes <i>Cutibacterium acnes</i>		
<i>Acinetobacter species</i>	19	2%	Total	133	
<i>Stenotrophomonas maltophilia</i>	16	2%	Mycobacterial Isolates	n	% of Mycobacterial Isolates
<i>Citrobacter freundii</i> complex	15	1%	<i>Mycobacterium abscessus</i> ssp <i>abscessus</i>	1	33%
<i>Morganella morganii</i>	13	1%	<i>Mycobacterium avium</i>	1	33%
<i>Klebsiella aerogenes</i>	8	1%	<i>Mycobacterium mucogenicum</i>	1	33%
Total	1031		Total	3	

Table 16. CSF: One Isolate per Patient (ALL), 2025

CSF Isolates (n = 49)	Number of Isolates	CSF Isolates (cont.)	Number of Isolates
Gram-positive bacteria (28)		Anaerobe (12)	
<i>Staphylococcus other than S.aureus</i>	12	<i>Cutibacterium (Propionibacterium) acnes</i>	11
<i>Streptococcus pneumoniae</i>	1	<i>Cutibacterium (Propionibacterium) avidum</i>	1
<i>Coryneform bacteria</i>	1		
<i>Enterococcus faecalis</i>	1	Fungi (10)	
<i>Streptococcus agalactiae</i>	1	<i>Cryptococcus neoformans</i>	6
<i>Enterococcus faecium</i>	1	<i>Coccidioides immitis/posadasii</i>	3
<i>Viridans group Streptococcus</i>	1	<i>Scedosporium apiospermum</i>	1
<i>Listeria monocytogenes</i>	1		
<i>Staphylococcus aureus</i>	1	Mycobacteria (1)	
	1	<i>Mycobacterium tuberculosis complex</i>	1
Gram-negative bacteria (6)			
<i>Pseudomonas aeruginosa</i>	3		
<i>Enterobacter cloacae complex</i>	2		
<i>Serratia marcescens</i>	1		

The following antimicrobial agents are not the drug of choice and may not be effective for treating infections caused by bacteria isolated from CSF:

- Agents administered by oral route only
- First- and second-generation cephalosporins and cephamycins
- Doripenem, ertapenem, and imipenem
- Clindamycin
- Lefamulin
- Macrolides
- Tetracyclines

Table 17. Mycobacteria, One Isolate per Patient per Source, 2025

Organisms	No. of Isolates	# Patients By Source ¹		
		Respiratory	Abscess/ wound/ tissue/other	Blood
<i>Mycobacterium avium complex</i>	363	350	12	1
<i>Mycobacterium gordonae</i>	36	33	3	
<i>Mycobacteroides (Mycobacterium) chelonae</i>	30	25	5	
<i>Mycobacterium abscessus</i>	29	25	3	1
<i>Mycolicibacterium (Mycobacterium) fortuitum group</i>	17	15	2	
<i>Mycobacterium tuberculosis complex</i>	13	10	3	
<i>Mycolicibacterium (Mycobacterium) mucogenicum</i>	11	10		1
<i>Mycobacteroides (Mycobacterium) immunogenum</i>	6	3	3	
<i>Mycobacterium kansasii</i>	4	3	1	
<i>Mycobacterium lentiflavum</i>	4	4		
<i>Mycobacterium xenopi</i>	4	4		
<i>Mycobacterium simiae</i>	2	2		
<i>Mycobacterium scrofulaceum</i>	2	2		
<i>Mycobacterium szulgai</i>	1		1	
<i>Mycolicibacterium (Mycobacterium) smegmatis</i>	1	1		
<i>Mycobacterium gilvum</i>	1	1		
<i>Mycobacterium arupense</i>	1	1		
<i>Mycobacterium mageritense</i>	1	1		
<i>Mycobacterium bovis</i>	1		1	
Total Mycobacteria	527	490	34	3

¹ Some patients have isolates in more than one source.

Table 18. Mycobacteria Antimicrobial Susceptibility Testing

1. *Mycobacterium tuberculosis* complex:

Performed on first isolate per patient; performed on additional isolates recovered after 3 months, testing performed at reference lab.

Primary agents	Secondary agents
Rifampin	Amikacin
Isoniazid (INH)	Capreomycin
Pyrazinamide	Ciprofloxacin
Ethambutol	Ethionamide
	p-aminosalicylic acid
	Streptomycin

2. *Mycobacterium avium* complex:

Performed on first isolate per patient; performed on additional isolates recovered after 3 months, testing performed at reference lab.

Correlation between in vitro susceptibility and clinical response has been demonstrated only for clarithromycin. Clarithromycin results predict azithromycin results. Susceptibility testing for clarithromycin should be performed on isolates from patients only when failing prior macrolide therapy or prophylaxis.

3. Rapidly growing *Mycobacterium* spp. (e.g. *M. abscessus*, *M. chelonae*, and *M. fortuitum* group):

Performed on one isolate per patient, testing performed in-house. Additional agents on request.

Agents routinely reported	Agents conditionally reported
amikacin	imipenem
cefoxitin	linezolid
ciprofloxacin	meropenem
clarithromycin (inducible)	moxifloxacin
doxycycline	tigecycline
trimethoprim-sulfamethoxazole	tobramycin (<i>M. chelonae</i> isolates only)

M. abscessus Clarithromycin and Amikacin drug resistance prediction and subspecies identification by Whole Genome Sequencing is performed by physician request only.

4. Other Nontuberculous Mycobacteria (NTM):

M. kansasii – Performed on one isolate per patient, at reference lab.
Other NTM by physician request.

Table 19. California Mycobacterium tuberculosis % Resistant, 2015-2025

Data derived from California Department of Public Health Annual report "California TB Snapshot"¹

Antimicrobial Agent	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Isoniazid	10.9%	10.9%	7.6% ²	ND	ND	ND	ND	ND	ND	ND	ND
Rifampin	1.4%	1.8%	0.4% ¹	ND	ND	ND	ND	ND	ND	ND	ND
Ethambutol	0.7%	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrazinamide	5.1%	5.4%	4.5% ¹	ND	ND	ND	ND	ND	ND	ND	ND
Multi-drug Resistant Tuberculosis rates ³	1.3%	1.8%	1.8%	1.2%	1.0%	1.0%	0.6%	0.9%	1.1%	1.0%	1.3%
MTB Case rate per 100,000 population	5.5	5.2	5.2	5.3	5.3	4.3	4.4	4.7	5.4	5.4	5.4
Number of new cases	2131	2059	2058	2092	2115	1706	1750	1843	2113	2100	2150

¹ <https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/TB-Disease-Data.aspx>

² Excludes multi-drug resistant cases.

³ Multi-drug resistant = Resistant to isoniazid and rifampin.

Table 20. Rapid Grower – Mycobacteria % Susceptible 2023-2025

Organism	No. Isolates	Amikacin ¹	Ciprofloxacin	Clarithromycin	Trimethoprim-sulfamethoxazole
<i>Mycobacterium abscessus</i> complex ^{2, 3, 4, 5}	88	90	R	51	R
<i>Mycobacterium fortuitum</i> ⁶	42	100	95	30	98
<i>Mycobacterium chelonae</i>	75	88	—	99	—

¹ Amikacin susceptible breakpoint: Susceptible ≤ 16 µg/mL CLSI M24S 2nd Edition 2023

² *M. abscessus* complex is differentiated into 3 subspecies: *M. abscessus* subsp. *abscessus*, *M. abscessus* subsp. *massiliense* and *M. abscessus* subsp. *bolletii*.

³ Some isolates of *M. abscessus* subsp. *abscessus* and *M. abscessus* subsp. *bolletii* may contain a functional *erm*(41) gene that confers inducible macrolide resistance. Resistance is detected in MIC at day 15, which is routinely tested for.

⁴ *M. abscessus* Clarithromycin and Amikacin drug resistance prediction and subspecies identification by Whole Genome Sequencing is available by physician request.

⁵ Subspecies identification by Whole Genome Sequencing (2020 – 2025) n = 37 *M. abscessus* subsp. *abscessus* = 65% (24), *M. abscessus* subsp. *massiliense* = 35% (13), *M. abscessus* subsp. *bolletii* = 0%.

⁶ All isolates of the *M. fortuitum* group, *M. mucogenicum* group and *M. smegmatis* group are presumed susceptible to imipenem based on clinical response data. CLSI M24S 2nd Edition 2023

Table 21. CLSI Anaerobic Bacteria Cumulative Antibigram, % Susceptible

Data derived from CLSI M100S 36th edition¹

Organism	Penicillin		Amoxicillin-Clavulanate		Piperacillin-Tazobactam		Ceftriaxone		Meropenem		Ertapenem		Clindamycin		Metronidazole		Moxifloxacin	
	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S
<i>Bacteroides fragilis</i>	3809	0	877	75	5497	97	856	44	1716	92	3801	95	5496	66	5503	98	2910	63
<i>Bacteroides ovatus</i>	—	—	14	64	466	94	—	—	142	99	—	—	467	32	467	100	250	29
<i>Bacteroides pyogenes</i>	228	70	34	94	196	99	31	84	40	100	—	—	244	81	244	100	113	97
<i>Bacteroides thetaiotaomicron</i>	889	0	166	67	1258	75	162	1	380	96	891	94	1256	16	1259	100	677	53
<i>Bacteroides uniformis</i>	—	—	64	72	430	99	64	14	124	99	—	—	430	43	430	100	229	38
<i>Parabacteroides distasonis</i>	333	0	51	49	426	72	53	32	95	98	—	—	426	25	426	100	246	52
<i>Phocaeicola dorei/vulgatus</i>	568	0	112	58	765	89	105	30	201	98	568	97	763	49	765	100	—	—
<i>Bacteroides</i> spp. and related genera, other ²	1989	2	107	69	2194	86	104	20	210	95	1990	94	2122	34	2194	100	1412	49
<i>Veillonella</i> spp. ³	933	28	141	96	839	76	157	98	137	99	713	95	995	91	994	96	602	64

¹ Isolates submitted from 3 reference laboratories from January 2017 to December 2024.

² Includes *Bacteroides* spp., *B.caccae*, *B.cellulosilytius/interstitialis*, *B.faecis*, *B.fragilis* Group, *B.intestinalis*, *B.ovatus/xylanisolvans*, *B.salyersiae/nordii*, *B.stercoris/eggerthii*, *B.thetaiotaomicron/faecis*, *Parabacteroides* spp., *P.goldsteinii*, *P.merdae*, *Phocaeicola* spp., *P.massiliensis*, *Bacteroides/Phocaeiocla* spp., and *Bacteroides/Parabacteroides/Phocaeicola* spp.

³ Includes *Veillonella* spp., *V. atypica*, *V. dispar*, and *V. parvula*

Table 21. CLSI Anaerobic Bacteria Cumulative Antibigram, % Susceptible (cont.)

Data derived from CLSI M100S 36th edition ¹

Prevotella spp.	Penicillin		Piperacillin-Tazobactam		Meropenem		Ertapenem		Clindamycin		Metronidazole		Moxifloxacin	
Organism	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S
<i>P. bergensis</i>	92	25	126	99	42	98	—	—	126	28	126	100	—	—
<i>P. bivia</i>	850	11	1145	100	337	100	813	100	1148	45	1148	97	610	9 ²
<i>P. buccae</i>	374	44	539	100	199	100	—	—	544	49	544	100	—	—
<i>P. buccalis</i>	103	39	127	100	50	100	—	—	128	43	128	100	—	—
<i>P. denticola</i>	275	26	371	100	121	100	—	—	375	51	375	100	—	—
<i>P. disiens</i>	178	16	225	100	56	100	—	—	224	30	225	100	—	—
<i>P. intermedia</i>	88	34	137	100	72	100	—	—	139	71	139	100	—	—
<i>P. melaninogenica</i>	432	9	480	100	61	100	—	—	480	65	479	100	—	—
<i>P. nigrescens</i>	144	32	200	100	91	100	—	—	201	55	201	100	—	—
<i>P. oralis</i>	104	70	113	100	—	—	—	—	114	61	114	100	—	—
<i>P. oris</i>	151	13	205	99	65	100	—	—	205	43	205	100	—	—
<i>P. timonensis</i>	163	30	188	100	58	100	—	—	191	34	191	100	—	—
Prevotella spp., Other ³	790	30	885	100	137	100	753	100	903	47	903	99	566	68

¹ Isolates submitted from 3 reference laboratories from January 2017 to December 2024.

² Forty-five percent of *P. bivia* isolates tested intermediate to moxifloxacin (MIC=4µg/ml). Isolates were from a single site.

³ Includes *Hollesella* spp., *Prevotella* spp., *P. baroniae*, *P. colorans*, *P. heparinolytica*, *P. histicola*, *P. jejuni*, *P. loesheii*, *P. melaninogenica* group, *P. nanciensis*, *P. salivae*, *P. veroralis*, and *Segatella* spp.

Table 21. CLSI Anaerobic Bacteria Cumulative Antibigram, % Susceptible (cont.)

Data derived from CLSI M100S 36th edition¹

Organism	Penicillin		Amoxicillin-Clavulanate		Piperacillin-Tazobactam		Ceftriaxone		Meropenem		Clindamycin		Metronidazole	
	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S
<i>Alistipes</i> spp. ²	89	27	—	—	89	91	—	—	—	—	89	73	89	100
<i>Bilophila wadsworthia</i>	77	16	—	—	78	63	—	—	—	—	79	92	78	100
<i>Campylobacter ureolyticus</i>	290	82	61	98	288	95	60	98	62	100	292	80	290	100
Anaerobic <i>Campylobacter</i> spp., other ³	188	53	—	—	186	65	—	—	—	—	189	84	188	100
<i>Desulfovibrio desulfuricans</i>	116	10	—	—	113	41	—	—	—	—	116	94	116	100
<i>Dialister micraerophilus</i>	174	92	—	—	170	100	—	—	57	100	175	57	169	46
<i>Dialister pneumosintes</i>	259	86	—	—	258	89	—	—	—	—	260	97	257	97
<i>Fusobacterium necrophorum</i>	682	93	394	100	677	98	392	99	389	100	684	99	684	100
<i>Fusobacterium nucleatum</i> ⁴	590	89	90	100	581	97	91	100	89	100	590	98	590	100
<i>Fusobacterium</i> spp. ⁵	540	81	—	—	520	92	39	95	30	97	540	91	541	100
<i>Porphyromonas</i> spp. ⁶	193	58	31	100	188	100	—	—	—	—	195	68	198	98
<i>Tissierella praecuta</i>	87	99	—	—	88	99	—	—	—	—	88	35	88	100

¹ Isolates submitted from 3 reference laboratories from January 1st, 2017 to December 31st, 2024.

² Includes: *Alistipes* spp., *A. finegoldii*, and *A. onderdonkii*

³ Includes: anaerobic *Campylobacter* spp., *C. concisus*, *C. curvus*, *C. gracilis*, *C. hominis*, *C. rectus*, and *C. showae*

⁴ *F. nucleatum* isolates tested 99% susceptible to ertapenem. Isolates tested from a single site (n=500)

⁵ Includes: *Fusobacterium* spp., *F. animalis*, *F. gonidiaformans*, *F. mortiferum*, *F. naviforme*//*nucleatum*, *F. periodonticum*, *F. russii*, *F. varium*, and *F. varium/ulcerans*

⁶ Includes: *Porphyromonas* spp., *P. asaccharolytica*, *P. gingivalis*, *P. levii*, *P. levii/somerae*, *P. macacae*, and *P. somerae*

Table 21. CLSI Anaerobic Bacteria Cumulative Antibigram, % Susceptible (cont.)

Data derived from CLSI M100S 36th edition¹

Organism	Penicillin		Amoxicillin-Clavulanate		Piperacillin-Tazobactam		Ceftriaxone		Meropenem		Ertapenem		Clindamycin		Metronidazole		Moxifloxacin	
	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S
<i>Clostridioides</i> (<i>Clostridium</i>) <i>difficile</i> ²	3438	8	—	—	3438	98	—	—	3285	98	—	—	3437	21	3442	99	—	—
<i>Clostridium cadaveris</i>	98	98	—	—	98	98	—	—	—	—	—	—	98	91	98	100	—	—
<i>Clostridium innocuum</i>	364	64	—	—	365	100	30	90	134	96	—	—	365	72	365	99	—	—
<i>Clostridium paraputrificum</i>	160	53	—	—	158	93	—	—	39	97	—	—	160	8	160	99	—	—
<i>Clostridium perfringens</i>	2236	96	318	100	2196	100	334	99	780	100	1428	100	2234	82	2236	100	1023	98
<i>Clostridium ramosum</i> (<i>Thomasclavelia ramosa</i>)	638	92	84	100	638	100	85	100	163	99	—	—	637	14	638	99	—	—
<i>Clostridium septicum</i>	319	98	—	—	320	100	—	—	—	—	—	—	319	99	319	99	—	—
<i>Clostridium tertium</i>	484	22	44	100	482	99	44	57	108	99	—	—	484	8	484	99	—	—
<i>Enterocloster clostridioformis</i>	151	31	—	—	150	82	—	—	37	97	—	—	150	68	151	100	—	—
<i>Hungatella hathewayi</i>	111	0	—	—	111	92	—	—	41	100	—	—	111	94	111	99	—	—
<i>Paenibacillus sordellii</i>	122	100	—	—	121	100	—	—	—	—	—	—	122	93	122	100	—	—
<i>Clostridium</i> spp. and related genera, other ³	1066	66	30	90	1064	95	34	91	248	96	821	99	1065	50	1065	99	618	63

¹ Isolates submitted from 3 reference laboratories from January 1st, 2017 to December 31st, 2024.

² Vancomycin MIC for 3033 *C.difficile* demonstrated 98% wild-type (MIC ≤ 2µg/ml). The majority of isolate (76%) were from intestinal sources.

³ Includes: *Clostridium/Clostridioides* spp., *Clostridium argentinense/shirmacherense*, *C.butyricum*, *C.combesii/sporogenes/botulinum*, *C.dsporicum*, *C.sartagoforme*, *C.saudiense*, *C.sporogenes/botulinum*, *C.sporogenes*, *C.subterminale*, *C.symbiosum*, *Clostridium/Eubacterium* spp., *Clostridium/Lacrimisporas* pp., *Enterocloster* spp., *E.aldenensis*, *E.boltea/clostridioformis*, *E.citroniae*, *Lacrimisporas* pp., *L.celerecrescens/indolis/sphenoides*, *L.sphenoides*, *Metaclostridioides* spp., *Paenibacillus* spp., *Paraclostridium* spp., and *P.bifermentans*

Table 21. CLSI Anaerobic Bacteria Cumulative Antibigram, % Susceptible (cont.)

Data derived from CLSI M100S 36th edition¹

Organism	Penicillin		Amoxicillin-Clavulanate		Piperacillin-Tazobactam		Ceftriaxone		Ertapenem		Clindamycin		Metronidazole		Moxifloxacin	
	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S
<i>Cutibacterium</i> (<i>Propionibacterium</i>) <i>acnes</i> ²	8025	100	1650	100	6282	100	2156	100	4774	100	6503	90	4964	2	6477	98
<i>Cutibacterium avidum</i>	808	100	113	100	638	100	149	100	536	100	655	60	545	0	698	94
<i>Eggerthella lenta</i>	943	2	96	100	763	65	104	15	671	100	943	90	945	99	574	49
<i>Lancefieldella</i> spp. ³	240	100	—	—	180	100	—	—	—	—	239	76	238	98	—	—
<i>Propionimicrobium lymphophilum</i>	91	100	—	—	74	100	—	—	—	—	79	41	—	—	—	—
<i>Propionibacterium</i> spp. and related genera, other ⁴	414	100	78	100	314	100	91	100	—	—	328	81	254	2	—	—
<i>Slackia exigua</i>	274	99	95	100	229	100	93	100	—	—	276	99	276	100	—	—
<i>Solobacterium moorei</i>	154	97	—	—	116	98	—	—	—	—	154	88	154	99	—	—

¹ Isolates submitted from 3 reference laboratories from January 1st, 2017 to December 31st, 2024.

² Vancomycin MIC for 1903 *C.acnes* isolates demonstrated 100% wild-type (MIC ≤ 2µg/ml).

³ Includes: *Lancefieldella* spp., *L.parvula*, and *L.rimae*

⁴ Includes: *Arachnia propionica*, *Cutibacterium* spp., *C.acnes/namnetense*, *Cutibacterium granulosum*, *C.modestum*, *C.namnetense*, *Cutibacterium/Propionibacterium* spp., and *Propionibacterium* spp.

Table 21. CLSI Anaerobic Bacteria Cumulative Antibigram, % Susceptible (cont.)

Data derived from CLSI M100S 36th edition¹

Organism	Penicillin		Amoxicillin-Clavulanate		Piperacillin-Tazobactam		Ceftriaxone		Meropenem		Ertapenem		Clindamycin		Metronidazole		Moxifloxacin	
	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S
Anaerococcus vaginalis	302	99	38	100	241	100	40	100	57	100	—	—	302	82	302	99	—	—
Anaerococcus spp. ²	612	88	90	96	471	99	96	87	93	100	—	—	612	64	612	100	—	—
Finnegoldia magna	3118	99	429	100	2483	100	453	100	734	100	1763	100	3118	58	3118	100	1562	50
Helcococcus spp. ³	102	100	35	100	85	100	37	100	35	100			102	66	71	10	—	—
Parvimonas micra	1687	99	245	100	1313	100	272	100	379	100	937	100	1685	90	1687	100	855	92
Peptoniphilus spp. ⁴	1221	98	35	100	961	100	43	100	124	100	840	100	1218	64	1220	100	752	82
Peptoniphilus hareii/ indolicus	554	98	—	—	421	100	69	100	161	100	—	—	555	70	555	100	—	—
Peptostreptococcus anaerobius	549	76	73	75	472	98	74	99	225	100	—	—	548	90	549	100	—	—
Peptostreptococcus spp., other ⁵	74	97	—	—	57	100	—	—	—	—	—	—	74	78	74	100	—	—
Anaerobic gram-positive cocci, other ⁶	191	96	—	—	157	99	—	—	—	—	—	—	191	77	189	97	—	—

¹ Isolates submitted from 3 reference laboratories from January 1st, 2017 to December 31st, 2024.

² Includes: *Anaerococcus* spp., *A. hydrogenalis*, *A. hydrogenalis/senegalensis*, *A. lactooyticus*, *A. murdochii*, *A. nageyae*, *A. octavius*, *A. prevotii*, and *A. tetradius*

³ Includes: *Helcococcus* spp., *H. kunzii*, and *H. sueciensis*

⁴ Includes: *Peptoniphilus* spp., *P. asaccharolyticus*, *P. coxii*, *P. duerdenii*, *P. gorbachii*, *P. lacrimalis*, and *P. timonensis*

⁵ Includes: *Peptostreptococcus* spp., *P. anaerobius/stomatis*, *P. canis* and *P. stomatis*

⁶ Includes: *Ezakiella* spp., *Fastidiosipila* spp., *Finnegoldia* spp., *Meidiannikoviiococcus* spp., *Murdochella* spp., *Parvimonas* spp., *Peptoanaerobacter* spp., *Peptococcus* spp., and *Ruminococcus* spp.

Table 22. Indications for Performing Routine Antimicrobial Susceptibility Tests – Aerobic Bacteria

Susceptibility tests will be performed as follows:

1. Blood—all isolates except*:

Aerococcus spp.¹ (excludes *Aerococcus urinae*)
Bacillus spp.¹
Corynebacterium spp.¹ (excludes *Corynebacterium jeikeium* and *Corynebacterium striatum*)
Coagulase-negative *Staphylococcus*^{1, 2}
Cutibacterium (*Propionibacterium*) *acnes*¹
Micrococcus spp.¹
Viridans group *Streptococcus*¹ (excludes *Streptococcus anginosus* group)

2. Urine

>10⁵ CFU/ml (1 or 2 species)

>50,000 CFU/ml (pure culture):

Gram-negative bacilli; *Staphylococcus aureus*

Urine from Urology – Susceptibility performed based on the following criteria upon request

Workup for up to 5 organisms;

Any quantity of pathogens

- Gram-negative bacilli
- *Staphylococcus aureus*

Potential pathogens – Colony count of ≥50K for ≤2 organisms

- Coagulase Negative *Staphylococcus*
- Viridans *Streptococcus*
- *Corynebacterium* species
- Yeast
- *Staphylococcus saprophyticus*
- *Aerococcus* species
- Beta hemolytic *Streptococcus*

Enterococcus species

- ≤2 organism any quantity
- Colony count of <50K Predominant in mix culture
- Colony count of ≥50K Non-predominant in mixed culture

3. Respiratory (sputum, nasopharynx, bronchial washing and tracheal aspirate):

Moderate /many growth ≤2 potential pathogens

Cystic fibrosis patients: any quantity of gram-negative bacilli, *S. aureus*, *S. pneumoniae*

4. Stool

Salmonella spp. (≤ 3 mo. only or susceptibilities performed on all isolates of *S. typhi* and *S. paratyphi*)
Shigella spp.
Yersinia spp.
Vibrio spp.

* Neonates (≤3 months), susceptibilities performed on all isolates

¹ Susceptibilities performed if isolated from multiple cultures

² Susceptibilities performed on all isolates of *S. lugdunensis*

Table 23. Indications for Performing Routine Antimicrobial Susceptibility Tests – Aerobic Bacteria (cont.)

5. Wounds, abscesses and other contaminated body sites, ≤ 2 potential pathogens.
6. If isolate is from sterile body site, susceptibility testing will be performed on subsequent isolates from similar site(s) every 3 days. Exception: *S. aureus* and *P. aeruginosa* tested each day of collection from blood.
7. If isolate is from non-sterile body site, susceptibility testing will be performed on subsequent isolates from similar site(s) every 5 days.

Additional notes:

- Susceptibility tests will not be performed on more than two potential pathogens per culture unless specifically requested following discussion with clinician.
- Blood and CSF isolates are held for 1 year.
- Other potentially significant isolates are held in lab for 7 days. Contact lab at (310) 794-2758 within 48 hours if susceptibilities are desired.

Table 23. Antimicrobial Agents Routinely Reported – Aerobic Bacteria

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s) ¹
<i>E. coli</i>, <i>Klebsiella</i> spp., <i>P. mirabilis</i> – Excludes urine isolates		
amoxicillin/clavulanate cefazolin ceftriaxone ciprofloxacin (>11 y.o.) levofloxacin (>11 y.o.) gentamicin piperacillin-tazobactam trimethoprim-sulfamethoxazole	Resistant to ceftriaxone Resistant to ertapenem (>3 mo.), Resistant to gentamicin Resistant to piperacillin-tazobactam	ertapenem (>3 mo.), imipenem & meropenem (≤18 y.o.) imipenem, meropenem amikacin, tobramycin ertapenem (>3 mo.), imipenem & meropenem (≤18 y.o.)
<i>E. coli</i>, <i>Klebsiella</i> spp., <i>P. mirabilis</i> – Urine isolates		
ampicillin amoxicillin/clavulanate oral cephalosporins ² ceftriaxone ciprofloxacin (>11 y.o.) levofloxacin (>11 y.o.) tobramycin nitrofurantoin trimethoprim-sulfamethoxazole	Resistant to ceftriaxone Resistant to ertapenem (>3 mo.)	ertapenem (>3 mo.), & meropenem (≤18 y.o.) meropenem

¹ The following additional antimicrobial agents are reported on carbapenem resistant Enterobacterales (resistant to meropenem and/or imipenem): azteonom, azithromycin, minocycline, moxifloxacin, tigecycline, ceftazidime-avibactam and ceftolozane-tazobactam.

Table 23. Antimicrobial Agents Routinely Reported – Aerobic Bacteria (cont.)

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s) ³
Other Enterobacterales organisms⁴ – Excludes urine isolates		
amoxicillin/clavulanate cefepime ceftriaxone ciprofloxacin (>11 y.o.) levofloxacin (>11 y.o.) gentamicin piperacillin-tazobactam ⁵ trimethoprim-sulfamethoxazole	Resistant to cefepime Resistant to ertapenem (>3 mo.) Not reported for HECK-Y organisms ⁵ Resistant to gentamicin Resistant to piperacillin-tazobactam	ertapenem (>3 mo.), imipenem & meropenem (≤18 y.o.) imipenem, meropenem amikacin, tobramycin ertapenem (>3 mo.), imipenem & meropenem (≤18 y.o.)
Other Enterobacterales organisms³ – Urine isolates		
ampicillin amoxicillin/clavulanate cefepime ceftriaxone ciprofloxacin (>11 y.o.) levofloxacin (>11 y.o.) tobramycin nitrofurantoin trimethoprim-sulfamethoxazole	Resistant to cefepime Resistant to ertapenem (>3 mo.) Not reported for HECK-Y organisms ⁵	ertapenem (>3 mo.) & meropenem (≤18 y.o.) meropenem

² Cefazolin results should only be used to predict potential effectiveness of oral cephalosporins for uncomplicated UTIs.

³ The following additional antimicrobial agents are reported on carbapenem resistant Enterobacterales (resistant to meropenem and/or imipenem): azteonom, azithromycin, minocycline, moxifloxacin, tigecycline, ceftazidime-avibactam and ceftolozane-tazobactam.

⁴ Enterobacterales other than *E. coli*, *Klebsiella* spp., *P. mirabilis*, *Salmonella* spp., *Shigella* spp.

⁵ Ceftriaxone not reported for *Citrobacter freundii* complex, *Enterobacter cloacae* complex, *Klebsiella aerogenes*, *Hafnia alvei*, *Yersinia enterocolitica*.

Table 23. Antimicrobial Agents Routinely Reported – Aerobic Bacteria (cont.)

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s) ¹
<i>Salmonella</i> spp.,¹ <i>Shigella</i> spp.²		
ampicillin ciprofloxacin (>11 y.o.) trimethoprim-sulfamethoxazole	<i>Shigella</i> spp. Non-fecal sources/resistant to all primary antimicrobials	azithromycin ceftriaxone
<i>Pseudomonas aeruginosa</i>		
cefepime ciprofloxacin (>11 y.o.) levofloxacin (>11 y.o.) Tobramycin piperacillin-tazobactam ceftazidime	Resistant to cefepime Resistant to imipenem or meropenem ceftolozane – tazobactam MIC ≥4 µg/mL Urine Resistant to piperacillin-tazobactam	imipenem, meropenem, ceftolozane - tazobactam ceftolozane - tazobactam cefiderocol amikacin imipenem, meropenem
<i>Acinetobacter</i> spp.		
cefepime ceftazidime ciprofloxacin (>11 y.o.) gentamicin piperacillin-tazobactam trimethoprim-sulfamethoxazole	Resistant to ceftazidime Resistant to meropenem or imipenem Resistant to gentamicin	imipenem, meropenem minocycline amikacin, tobramycin
<i>Stenotrophomonas maltophilia</i>- Sterile body site isolates		
levofloxacin (>11 y.o.) minocycline trimethoprim-sulfamethoxazole		

¹ If stool isolates, perform on patients ≤3 mo., or if isolate is *Salmonella typhi* or *Salmonella paratyphi* A.

² Susceptibility performed on stool isolates

Table 23. Antimicrobial Agents Routinely Reported – Aerobic Bacteria (cont.)

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s)
Nonfermenting Gram Negative Rods not otherwise listed		
cefepime		
ceftazidime	Resistant to ceftazidime	imipenem, meropenem
ciprofloxacin (>11 y.o.) levofloxacin (>11 y.o.)		
gentamicin	If gentamicin >1 µg/ml	amikacin, tobramycin
piperacillin-tazobactam		
trimethoprim-sulfamethoxazole		
<i>Haemophilus influenzae</i>		
Beta-lactamase test	Sterile body site isolates:	Reported upon request:
	If beta-lactamase positive	ceftriaxone
	If beta-lactamase negative	ampicillin, ceftriaxone
	CSF only	Meropenem

Table 23. Antimicrobial Agents Routinely Reported – Aerobic Bacteria (cont.)

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s)
<i>Staphylococcus</i> spp.		
clindamycin ¹		
oxacillin	Exclude Blood and CSF Resistant to oxacillin (MRSA)	tetracycline/doxycycline, trimethoprim-sulfamethoxazole All beta-lactams considered resistant except ceftaroline
penicillin		
vancomycin	<i>S. aureus</i> on blood (vancomycin ≥2µg/ml) Urine isolates	daptomycin, linezolid ciprofloxacin ² , nitrofurantoin, trimethoprim-sulfamethoxazole
<i>Enterococcus</i> spp.		
ampicillin		
vancomycin	Resistant to vancomycin (VRE) from sterile body sites Sterile body site isolates Urine isolates	daptomycin, doxycycline, linezolid, quinupristin-dalfopristin (excluding <i>E. faecalis</i>), rifampin gentamicin (high level) ciprofloxacin ² , doxycycline, nitrofurantoin
<i>Streptococcus pneumoniae</i>		
amoxicillin, cefotaxime, ceftriaxone, erythromycin ³ , levofloxacin ² , penicillin, tetracycline ³ , trimethoprim-sulfamethoxazole ³ , vancomycin		
Viridans group <i>Streptococcus</i>		
cefotaxime, ceftriaxone, penicillin, vancomycin		
Beta-hemolytic <i>Streptococcus</i>		
Clindamycin ¹ , penicillin, vancomycin		
<i>Listeria monocytogenes</i>		
penicillin, trimethoprim-sulfamethoxazole (penicillin results predicts ampicillin results)		

¹ Excluding urine and CSF isolates

² Patients >11 y.o.

³ Excluding CSF isolates

Table 24: CLSI M62 – Expected Antimicrobial Susceptibility Patterns of the Most Commonly Isolated Nocardia Data Derived from CLSI M24S 2nd Ed.⁴

Organism	Amoxicillin/ clavulanic acid	Ceftriaxone	Imipenem	Ciprofloxacin	Minocycline	Linezolid	Trimethoprim – sulfamethoxazole	Amikacin	Tobramycin	Clarithromycin
<i>N. abscessus</i>	S	S	V	R	V	S	S	S	V	R
<i>N. brasiliensis</i>	S	V	R	R	V ¹	S	S	S	S	R
<i>N. cyriacigeorgica</i>	R	S	V	R	V	S	S	S	S	R
<i>N. farcinica</i>	S	R	V	V	V	S	S	S	R	R
<i>N. nova complex</i> ²	R	V	S	R	V	S	S	S	R	S
<i>N. otitiscaviarum</i>	R	R	R	V	V	S	S	S	S	V
<i>N. pseudobrasiliensis</i>	R	R	R	S	R	S	V	S	S	S
<i>N. transvalensis complex</i> ³	V	S	V	S	V	S	S	R	R	R

¹ Most isoaltes of *N. brasiliensis* appear to be susceptible or intermediate to minocycline.

² *N. nova complex* includes *N. africana*, *N. elegans*, *N. kruczakiae*, *N. nova*, and *N. veterana*

³ *N. transvalensis complex* include *N. blacklockiae*, *N. transvalnesis*, and *N. wallacei*

⁴ Adapted from CLSI M24S 2nd edition, February 2023

Table 25. Susceptible MIC (µg/mL) Breakpoints for Aerobic Gram-negative Bacilli ¹

	Penicillins			Cephalosporins					Carbapenems			Amino-glycosides			Fluoro-quinolones		Other								
	Ampicillin	Amoxicillin-clavulanate	Piperacillin-tazobactam	Cefazolin	Cefepime	Cefotaxime	Ceftazidime	Ceftriaxone	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin ²	Levofloxacin ³	Colistin ⁴	Trimethoprim – sulfamethoxazole	Nitrofurantoin	Minocycline	Tigecycline	Ceftolozane-tazobactam	Ceftazidime-avibactam	Meropenem-vaborbactam	
<i>Enterobacterales</i>	≤8	≤8	≤8	≤2	≤2	≤1	≤4	≤1	≤0.5	≤1	≤1	≤4	≤2	≤2	≤0.25	≤0.5	≤2	≤2/38	≤32	≤4	≤2	≤2/4	≤8/4	≤4/8	
NONFERMENTERS																									
<i>Acinetobacter species</i> ⁵	R	≤8	≤16	R	≤8	≤8	≤8	≤8	R	≤2	≤2	≤8	≤2	≤2	≤1	≤2	≤2	≤2/38	—	≤1	—	—	—	—	
<i>Pseudomonas aeruginosa</i>	R	R	≤16	R	≤8	R	≤8	R	R	≤2	≤2	≤16 ⁶	—	≤1	≤0.5	≤1	≤2	R	—	—	R	≤4/4	≤8/4	—	
<i>Stenotrophomonas maltophilia</i>	R	R	R	R	—	R	—	R	R	R	R	R	R	R	—	≤2	—	≤2/38	—	≤1	—	—	—	—	
Other non-fermenters	—	—	≤16	—	≤8	≤8	≤8	≤8	—	≤4	≤4	≤16	≤4	≤4	≤1	≤2	—	≤2/38	—	≤4	—	—	—	—	

¹ Data derived from CLSI M100 36th edition.

² *Salmonella* spp. breakpoint for ciprofloxacin ≤ 0.06 µg/ml

³ *Salmonella* spp. breakpoint for levofloxacin ≤ 0.12 µg/ml

⁴ There are no susceptible category for colistin. The MIC is based on the new CLSI Intermediate breakpoint at for Colistin at ≤ 2 µg/mL

⁵ *Acinetobacter* spp. breakpoint for Ampicillin-sulbactam ≤ 8 µg/ml

⁶ Amikacin breakpoints for *Pseudomonas aeruginosa* for Urine sources only.

Table 26. Susceptible MIC (µg/mL) Breakpoints for Aerobic Gram-positive Cocci ¹

Organism	Penicillins			Cephalo- sporin	Aminogly- cosides		Fluoro- quinolone	Other									
	Ampicillin	Oxacillin	Penicillin	Ceftaroline	Gentamicin	Gentamicin synergy	Ciprofloxacin	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Linezolid	Nitrofurantoin	Quinupristin- dalbapristin	Rifampin	Trimethoprim – sulfamethoxazole	Vancomycin
<i>Staphylococcus aureus</i> ² <i>Staphylococcus lugdunensis</i>	–	≤2	≤0.12	≤1	≤4	–	≤1	≤0.5	≤1	≤4	≤0.5	≤4	≤32	≤1	≤1	≤2/38	≤2
Staphylococci other than <i>Staphylococcus aureus</i> (SOSA)	–	≤0.5	≤0.12 ³	–	≤4	–	≤1	≤0.5	≤1	≤4	≤0.5	≤4	≤32	≤1	≤1	≤2/38	≤4
<i>Enterococcus</i> spp. <i>Enterococcus faecalis</i>	≤8	–	≤8	R	R	≤500	≤1	R	≤2	≤4	R	≤2	≤32	≤1	≤1	R	≤4
<i>Enterococcus faecium</i>	≤8	–	≤8	R	R	≤500	≤1	R	≤4	≤4	R	≤2	≤32	≤1	≤1	R	≤4

Organism	Penicillins		Cephalosporins		Tetracyclines		Other		
	Amoxicillin	Penicillin	Cefotaxime	Ceftriaxone	Doxycycline	Tetracycline	Erythromycin	Levofloxacin	Vancomycin
<i>Streptococcus pneumoniae</i>	–	–	–	–	≤0.25	≤1	–	≤2	≤1
Meningitis	–	≤0.06	≤0.5	≤0.5	–	–	–	–	–
Non-meningitis	≤2	≤2	≤1	≤1	–	–	≤0.25	–	–
Viridans group <i>Streptococcus</i>	–	≤0.12	≤1	≤1	–	–	–	–	≤1

¹ Data derived from CLSI M100 36th edition.

² *S. aureus* only, including MRSA

³ beta-lactamase negative

Table 27. Antimicrobial Stewardship

- 1) Treatment of asymptomatic bacteriuria
 - a. A urine culture must ALWAYS be interpreted in the context of the urinalysis and patient symptoms.
 - b. If a patient has no signs of infection on urinalysis and no symptoms of infection, but a positive urine culture, the patient by definition has **asymptomatic bacteriuria**.
 - c. Patients with chronic indwelling catheters, urinary stoma, and neobladders will almost universally have positive urine cultures.
 - d. The only patient populations for which it is recommended to screen for and treat asymptomatic bacteriuria are **pregnant women** and **patients scheduled for a genitourinary surgical procedure**. Screening during the first 2 months of renal transplant is acceptable.
 - e. Avoid routine urine analysis and/or urine cultures for the sole purpose of screening for UTI in asymptomatic patients.
- 2) Treatment of VRE Isolated from stool cultures
 - a. *Enterococcus* are normal bowel flora and do not cause enteric infections, regardless of vancomycin susceptibility.
 - b. Antibiotic treatment of VRE in stool cultures is discouraged, and may lead to increased transmission by causing diarrhea and emergence of antimicrobial resistance among VRE.
- 3) Treatment of *Candida* isolated from bronchoscopic samples in non-neutropenic patients
 - a. Isolation of *Candida*, even in high concentrations, from respiratory samples of immunocompetent patients, including bronchoscopy, should be interpreted as airway colonization.
 - b. Antifungal therapy should not be initiated unless *Candida* is also isolated from sterile specimens or by histologic evidence in tissue from at-risk patients.
- 4) Use of “double coverage” for gram-negative bacteria
 - a. “Double coverage” of suspected gram-negative infections serves the purpose of providing broad spectrum initial empiric coverage until susceptibility data are known.
 - b. No evidence exists to support the superiority of combination therapy over monotherapy for gram-negative infections once susceptibilities are known.
 - c. Once culture identification and susceptibilities have been reported, de-escalation to a single agent is strongly recommended.
- 5) Use of two agents with anaerobic activity to treat infections with potential anaerobic bacteria involvement
 - a. Double anaerobic coverage is not necessary and puts the patient at risk for additional drug toxicities. No data or guidelines support double anaerobic coverage in clinical practice.
 - b. Example: use of piperacillin/tazobactam + metronidazole.
 - c. Two clinical exceptions are:
 - i. Addition of metronidazole to another agent with anaerobic activity to treat *Clostridioides difficile* infection.
 - ii. Clindamycin added to another agent with anaerobic activity when treating necrotizing fasciitis.

For additional information, refer to the Antimicrobial Stewardship website, <https://asp.mednet.ucla.edu/pages/>