UCLA Health System

Antimicrobial Susceptibility Summary 2025

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/

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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 2024.

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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Bushra Rahman, MPH, Program Manager
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, 35th 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 Antimicrobial Stewardship hotline.

Clinical Microbiology
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171315

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/
Note that the website has a **guidebook**, with detailed information about specific clinical syndromes, interpretation of microbiology reports, and guidelines for treatment.

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, BCID, ID Pharmacist
- Meganne Kanatani, PharmD, BCIDP, ID Pharmacist
- Daniel Uslan, MD, Chief Infection Prevention
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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	Multi-drug 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
Enterobacter cloacae complex[2]	OP	106	R	R	R	91	R	99	—[3]	—[3]	99	99	99	99	96	95	91	93	90
	IP	129	R	R	R	67	R	96	—[3]	—[3]	89	98	98	99	98	98	88	88	89
	ICU	44	R	R	R	59	R	95	—[3]	—[3]	89	95	98	99	99	98	86	86	89
Escherichia coli	OP	401	—	72	—	95	54	84	80	75	99	99	99	94	83	80	63	67	59
	IP	444	—	64	—	89	44	82	73	66	99	99	99	92	81	78	54	59	56
	ICU	135	—	58	—	89	37	74	65	60	98	99	99	91	79	73	47	51	52
Klebsiella pneumoniae	OP	178	R	84	—	96	75	87	85	83	99	99	99	99	92	89	81	85	80
	IP	281	R	76	—	87	62	79	74	73	95	97	97	97	85	81	70	78	69
	ICU	122	R	71	—	84	61	75	71	70	93	97	97	96	82	77	72	79	70
Proteus mirabilis	OP	133	—	91	—	99	9	97	99	88	99	—[4]	99	89	89	89	77	78	74
	IP	114	—	85	—	98	10	95	96	74	99	—[4]	99	85	82	78	54	54	57
	ICU	42	—	83	—	98	12	93	95	60	99	—[4]	99	90	81	74	45	45	51
Pseudomonas aeruginosa	OP	512	R	R	R	87	R	90	90	R	R	88	89	—[5]	—[5]	91	80	76	R
	IP	430	R	R	R	78	R	88	81	R	R	80	84	—[5]	—[5]	93	80	73	R
	ICU	162	R	R	R	65	R	78	69	R	R	66	71	—[5]	—[5]	93	73	67	R

[1] %S includes %SDD

[2] *Enterobacter cloacae* complex includes *E.cloacae, E.asburiae, and E.hormaecheii.*

[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] 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
Citrobacter freundii complex[2]	106	R	73	R	95	—[3]	—[3]	97	99	99	98	89	86	84	85	79
Klebsiella (Enterobacter) aerogenes	166	R	83	R	99	—[3]	—[3]	99	96	99	98	98	98	96	98	98
Enterobacter cloacae complex[4]	255	R	78	R	98	—[3]	—[3]	94	98	99	99	98	97	90	92	91
Escherichia coli	857	68	93	50	84	78	72	99	99	99	93	83	80	60	65	59
Klebsiella oxytoca	191	86	91	15	97	94	86	99	99	99	99	94	93	92	98	90
Klebsiella pneumoniae	469	81	91	68	83	80	77	97	97	98	98	88	85	76	82	75
Morganella morganii	85	R	99	0	99	—[3]	—[3]	99	—[5]	99	94	87	93	74	75	76
Proteus mirabilis	259	88	99	10	97	97	83	99	—[5]	99	88	87	85	68	69	68
Serratia marcescens	217	R	94	R	98	95	85	98	95	99	94	97	83	83	90	98
Acinetobacter baumannii complex [6]	53	13	58	R	62	65	—	—	65	65	77	79	83	74	75	81
Pseudomonas aeruginosa	944	R	84	R	89	87	R	R	85	88	—[7]	—[7]	92	80	75	R
Stenotrophomonas maltophilia[8]	112	R	—	R	—	—	R	R	R	R	R	R	R	—	50[9]	99[9]
Achromobacter spp.	72	—	90	R	13	68	—	—	88	86	10	6	7	13	54	90

[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. hormaecheii.*
[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 = 88%
[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			Aminoglycoside			Fluoro-quinolone		Other		
			Ampicillin	Amoxicillin – Clavulanic acid	Oral Cephalosporin [1]	Cefepime [2]	Ceftazidime	Ceftriaxone	Ertapenem	Imipenem	Meropenem	Gentamicin	Tobramycin	Amikacin	Ciprofloxacin	Levofloxacin	Nitrofurantoin	Trimethoprim/ sulfamethoxazole	Piperacillin/ Tazobactam [2]
Enterobacter cloacae complex	OP	223	R	R	R	97	— [3]	— [3]	95	99	99	98	97	—	90	88	35	90	78
	IP	35	R	R	R	89	— [3]	— [3]	91	99	99	97	97	—	97	94	53	89	60
Escherichia coli	OP	10435	56	87	87	—	—	89	99	99	99	90	89	—	78	72	98	75	96
	IP	443	36	73	62	—	—	66	98	99	98	79	77	—	59	51	95	63	90
Klebsiella pneumoniae	OP	1687	R	R	86	—	—	87	99	99	99	94	92	—	84	82	28	83	94
	IP	157	R	R	71	—	—	71	97	97	97	85	83	—	68	64	24	69	86
Proteus mirabilis	OP	1024	83	82	94	—	—	95	99	—	99	93	94	—	87	87	R	82	99
	IP	91	66	67	82	—	—	84	99	—	99	85	76	—	70	70	R	67	98
Pseudomonas aeruginosa	OP	475	R	R	R	96	94	R	R	89	94	— [4]	98	99	87	81	R	R	90
	IP	99	R	R	R	92	84	R	R	81	85	— [4]	95	98	84	73	R	R	80

[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	Doxycycline	Erythromycin	Linezolid	Rifampin [2]	Trimethoprim sulfamethoxazole	Vancomycin	Ceftaroline
Staphylococcus aureus	OP	1959	76	25	79	73	99	95	56	99	99	94	99	99
	IP	498	70	22	71	69	99	98	50	99	99	94	99	99
	ICU	202	64	20	63	67	99	99	50	99	98	93	99	99
Oxacillin-resistant *S. aureus* (MRSA)	OP	455	R [1]	R [1]	37	70	99	89	18	99	98	85	99	99
	IP	159	R [1]	R [1]	27	60	99	89	13	99	98	92	99	99
	ICU	76	R [1]	R [1]	18	58	99	99	17	99	96	91	99	99
Oxacillin-susceptible *S. aureus* (MSSA)	OP	1410	100	34	93	74	99	97	68	99	99	96	99	99
	IP	343	100	31	91	72	99	99	66	99	99	95	99	99
	ICU	127	100	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] 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	Erythromycin	Linezolid	Rifampin [2]	Trimethoprim sulfamethoxazole	Vancomycin	Ceftaroline
Staphylococcus epidermidis	All	580	—	47	14	—	65	65	99	88	40	99	98	66	99	—
Staphylococcus haemolyticus	All	62	—	50	44	—	58	52	99	99	31	99	90	79	99	—
Staphylococcus lugdunensis [3]	All	382	—	90	43	—	99	87	99	99	84	99	99	99	99	—
Staphylococcus pseudintermedius/ intermedius	All	62	—	63	10	—	71	59	99	71	50	99	99	55	99	—
Coagulase negative *Staphylococcus* [4,5]	All	189	—	66	22	—	76	69	99	91	50	99	99	78	99	—
Enterococcus spp.[6] [7]	All	42	88	—	—	—[8]	64	R	80	48	39	99	50	R	83	R
Enterococcus faecalis [7]	All	631	99	—	—	81[9]	63	R	90	36	R	99	19	R	97	R
Enterococcus faecium [7]	All	197	16	—	—	92[9]	9	R	90[10]	40	R	96	9	R	41	R

[1] High level gentamicin 500µg/mL.
[2] Rifampin should not be used as monotherapy.
[3] *S. lugdunensis* is best treated with a Beta-lactam agent.
[4] *S. saprophyticus* urinary tract infections respond to antibiotic concentrations achieved in urine with agents commonly used to treat acute uncomplicated UTIs.
[5] Excluding *S. epidermidis*, *S. lugdunensis* and *S. pseudintermedius.*
[6] Serious Enterococcal infections need combination therapy of ampicillin plus ceftriaxone or an aminoglycoside.
[7] Enterococcus spp. excludes *E.faecalis* and *E.faecium.*
[8] Insufficient data to calculate % susceptible.
[9] % susceptible calculated with isolates tested from sterile body sites. E. faecalis n=73 and E. faecium n=92.
[10] % susceptible includes susceptible dose dependent.

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

Organism	No. Isolates	Penicillins		Cephalosporins			Other					
		Amoxicillin	Penicillin	Cefotaxime	Ceftriaxone	Clindamycin	Doxycycline	Erythromycin	Levofloxacin	Trimethoprim – sulfamethoxazole	Tetracycline	Vancomycin
Streptococcus pneumoniae	39	97	—	—	—	82	72	56	100	82	—	100
Meningitis [1]		—	64	90	90	—	—	—	—	—	—	—
Non-meningitis [2]		—	97	97	97	—	—	—	—	—	—	—
Viridans group *Streptococcus spp.* [3]	113	—	57 [4]	97	96	—	—	—	—	—	—	100
Streptococcus anginosus group	87	—	97	99	99	—	—	—	—	—	—	100
Streptococcus agalactiae (Group B streptococci)	125	—	99	—	—	41	—	—	—	—	—	100
Streptococcus pyogenes (Group A streptococci)	36	—	100	—	—	75	—	72	—	—	72	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).

Table 5. Miscellaneous Gram-negative Bacteria

Organism	No. Isolates	% beta-lactamase positive[1]
Haemophilus influenzae	146 (pts. >21 y.o) 46 (pts. ≤21 y.o.)	29 21
Moraxella catarrhalis	64 (pts. >21 y.o) 21 (pts. ≤21 y.o.)	92 100
Neisseria gonorrhoeae	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	
Neisseria meningitidis	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

Organism	Amikacin		Aztreonam		Ceftazidime-Avibactam [1]		Ceftolozane-Tazobactam [1]		Tigecycline [2]		Meropenem-Vaborbactam [1]		Eravacycline [1, 2, 3]		Omadacycline [2, 4]	
	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	81	89	4	349	93	350	67	97	90	94	78	94	68	94	71

[1]Restricted 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 pneumonia.*
[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 (ABSSSI).

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
Pseudomonas aeruginosa, **Imipenem or Meropenem resistant**	229	92 [2]	—	49	46	62	57	83	91	0	R
Pseudomonas aeruginosa, **Imipenem and Meropenem resistant**	142	89 [6]	—	38	28	45	44	77	87	0	R
Acinetobacter baumannii complex [3]**,** **Meropenem resistant**	21 [4]	43	48	33	5	10	24	—	—	67	52

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

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

Organism	No. Isolates	Penicillins				Cephalosporins				Carbapenems			Aminoglycosides			Fluoroquin-olone	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
Enterobacter cloacae complex [4]	39	R	R	R	87	R	99	— [5]	— [5]	92	99	99	99	99	99	97	95
Escherichia coli	83	—	78	—	93	60	82	87	81	99	99	99	96	82	83	77	64
Klebsiella pneumoniae	41	R	93	—	95	73	90	90	85	99	99	99	99	93	95	90	88
Serratia marcescens	31	R	R	R	97	R	99	—	—	99	99	99	97	99	90	87	99
Pseudomonas aeruginosa	91	R	R	R	82	R	87	87	R	R	88	90	—[6]	—[6]	92	85	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.hormaecheii.*
[5] 3rd generation cephalosporins should not be used for serious infections.
[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 9. Pediatrics (≤ 21 y.o.) Gram-negative Bacteria – Urine Isolates, % Susceptible

Organism	No. Isolates	Penicillins		Cephalosporins				Carbapenems			Amino-glycosides			Fluoroqui-nolone	Other	
		Ampicillin	Amoxicillin - Clavulanic acid	Oral Cephalosporins [1]	Cefepime	Ceftazidime	Ceftriaxone	Ertapenem	Imipenem	Meropenem	Amikacin	Gentamicin	Tobramycin	Ciprofloxacin [2]	Trimethoprim – sulfamethoxazole	Nitrofurantoin
Enterobacter cloacae complex [3]	14 [4]	R	R	R	86	—	—	93	99	99	—	99	—	93	93	29
Klebsiella (Enterobacter) aerogenes	29 [4]	R	R	R	88	—	—	99	97	99	—	97	—	86	90	14
Escherichia coli	1000	58	86	91	—	—	92	99	99	99	—	91	91	85	76	99
Klebsiella pneumoniae	88	R	95	91	—	—	92	99	99	99	—	92	93	90	92	25
Proteus mirabilis	116	84	84	96	—	—	98	99	—[5]	99	—	95	97	97	84	R
Pseudomonas aeruginosa	38	R	R	R	89	89	R	R	95	97	99	—[6]	99	97	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.hormaecheii.*
[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			Cephalos-porins		Others									
			Ampicillin	Oxacillin	Penicillin	Ceftriaxone	Cefotaxime	Ciprofloxacin [1]	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Linezolid	Rifampin [2]	Trimethoprim-sulfamethoxazole	Vancomycin	Ceftaroline
Staphylococcus aureus (All)	OP	432	—	89	23	—	—	93	82	99	99	68	99	99	97	99	99
	IP	101	—	75	17	—	—	75	79	99	99	58	99	99	97	99	99
Oxacillin-resistant *S. aureus* (MRSA) [3]	OP	48	—	R[3]	R[3]	R[3]	R[3]	54	81	99	99	40	99	99	88	99	99
	IP	27 [4]	—	R[3]	R[3]	R[3]	R[3]	26	85	99	99	19	99	96	93	99	99
Oxacillin-susceptible *S. aureus* (MSSA)	OP	386	—	99	30	—	—	97	83	99	99	72	99	99	98	99	99
	IP	76	—	99	40	—	—	92	78	99	99	71	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] Rifampin should not be used as monotherapy.

[3] *Staphylococcus* resistant to oxacillin are resistant to cefazolin, cephalexin, ceftriaxone and all other beta-lactams except ceftaroline.

[4] 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			Cephalos-porins		Others										
			Ampicillin	Oxacillin	Penicillin	Ceftriaxone	Cefotaxime	High Level Gentamicin [1]	Ciprofloxacin [2]	Clindamycin	Daptomycin	Doxycycline	Erythromycin	Linezolid	Rifampin [3]	Trimethoprim-sulfamethoxazole	Vancomycin	Ceftaroline
Coagulase negative *Staphylococcus*[4]	OP	50	—	68	33	—	—	—	50	99	50	40	99	99	88	99	99	—
	IP	14 [5]	—	57	25	—	—	—	86	46	99	99	50	99	93	86	99	—
Staphylococcus epidermidis	All	57	—	37	10	—	—	—	81	52	99	89	23	99	98	68	99	—
Staphylococcus lugdunensis	All	41	—	96	50	—	—	—	99	80	99	99	80	99	99	99	99	—
Enterococcus faecalis	All	55	99	—	—	R	R	78	75	R	99	22	R	99	16	R	99	—
Enterococcus faecium	All	8 [5]	38	—	—	R	R	88	13	R	99[5]	63	R	99	13	R	63	—

[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] Rifampin should not be used as monotherapy.

[4] *Staphylococcus* other than *S. aureus* (SOSA), excludes *S. epidermidis* and *S. lugdunensis.*

[5] 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
Viridans group Streptococcus	24 [1]	—	79	96	96	—	—	—	—	100
Streptococcus anginosus	11 [1]	—	100	100	100	—	—	—	—	100
Streptococcus pneumoniae	10 [1]	90	—	—	—	90	70	60	80	100
Meningitis [2]		—	70	70	70	—	—	—	—	—
Non-meningitis [3]		—	90	90	90	—	—	—	—	—

[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, 2023-2024

1. 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.
2. Isolation of Candida in respiratory specimens of immunocompetent patients should be interpreted as airway colonization.

		Percent Susceptible, Susceptible Dose Dependent, Intermediate, Resistant at Breakpoints[1], [2], [3]														
Organism	**N**	**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
Candida albicans	327	≤ 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
		88	6	6	86	13	1	99	0	0	99	0	0	99	0	0
Candida glabrata	207	—	≤ 32	≥ 64	— [5]	— [5]	— [5]	≤ 0.12	0.25	≥ 0.5	≤ 0.06	0.12	≥ 0.25	≤ 0.12	0.25	≥ 0.5
		—	85	15	— [5]	— [5]	— [5]	93	6	1	98	0	1	98	0	1
Candida parapsilosis	70	≤ 2	4	≥ 8	≤ 0.12	0.25-0.5	≥ 1	≤ 2	4	≥ 8	≤ 2	4	≥ 8	≤ 2	4	≥ 8
		87	3	10	90	4	6	99	0	0	99	0	0	99	0	0
Candida tropicalis	60	≤ 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
		83	5	12	85	7	8	97	2	2	99	0	0	98	2	0
Candida krusei	29 [6]	—	—	—	≤ 0.5	1	≥ 2	≤ 0.25	0.5	≥ 1	≤ 0.25	0.5	≥ 1	≤ 0.25	0.5	≥ 1
		R	R	R	99	0	0	90	7	3	96	0	4	97	0	3
Candida guilliermondii	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.

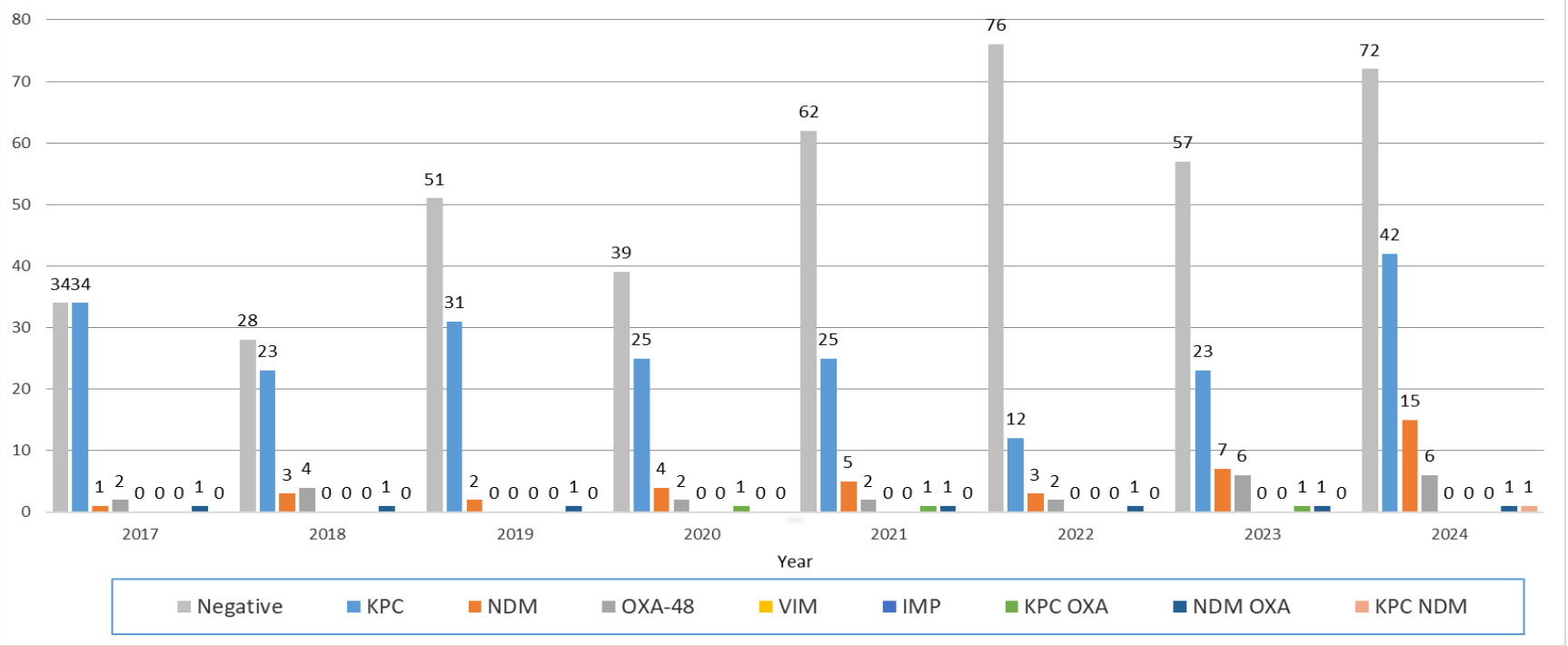
Organism	If Resistant to:	Therapeutic Options	Comments
Candida krusei	micafungin	voriconazole[1] amphotericin[2]	Typically susceptible to micafungin. Breakthrough infections have been reported.[3]
	voriconazole	micafungin [4] amphotericin[2, 5]	Intrinsically resistant to fluconazole[6, 7] Typically susceptible to voriconazole[6, 7]
Candida glabrata	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]
Candida albicans	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]
Candida auris	Often resistant to azoles, amphotericin and some are echinocandin resistant	Infectious Disease consult is strongly suggested	*Candida auris* 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. Infections Disease consult is highly recommended.

Table 13. Carbapenem-resistant Enterobacterales (CRE), 2018-2024

Year	CRE All	CPE	Non-CP CRE	KPC	OXA	NDM	KPC & NDM	NDM & OXA	KPC & OXA	VIM	IMP
2017	72	38	42	38	3	1	0	1	0	0	0
2018	59	31	31	24	4	3	0	1	0	0	0
2019	85	34	25	32	0	2	0	1	0	0	0
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



[1] Includes CPE Surveillance Cultures results

Table 13. Carbapenem-resistant Pseudomonas aeruginosa (CRPA), 2023-2024 (Cont.)

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

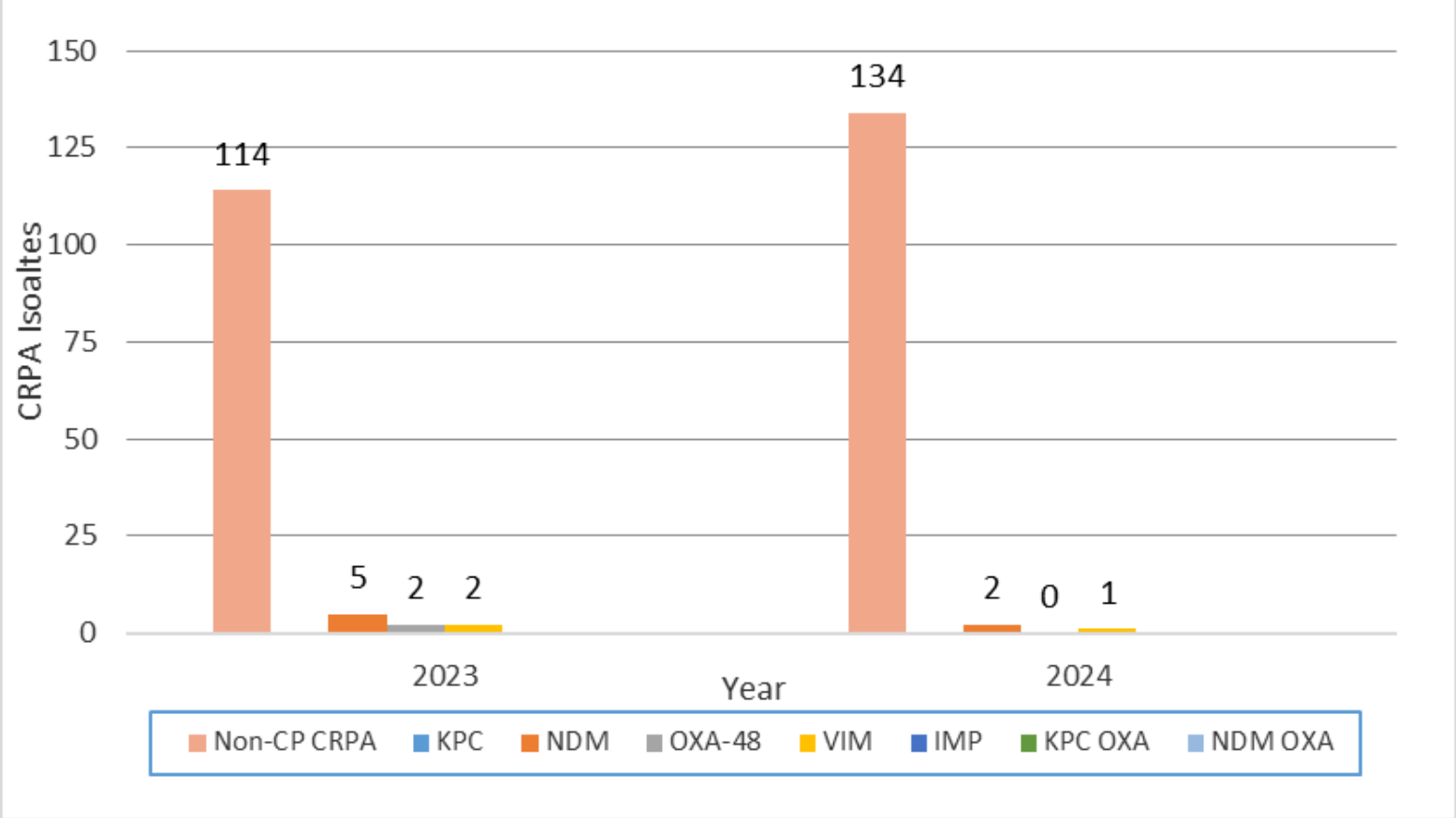


Table 14. Treatment Suggestions for Organisms for which Susceptibility Testing is not Routinely Performed

Organism	Recommended	Alternate treatment	Comments / Also Effective
Aerococcus urinae	Amoxicillin	Levofloxacin or Ciprofloxacin	Fluoroquinolones resistant strains (27%-33%) have been reported. [1]
Bordetella pertussis[2]	Azithromycin or Clarithromycin	Trimethoprim-sulfamethoxazole	
Campylobacter jejuni[2]	Azithromycin	Consult with ID	Trimethoprim-sulfamethoxazole, Penicillin & Cephalosporins **NOT Active**
Campylobacter fetus[2]	Gentamicin	Imipenem or Ceftriaxone	Ampicillin
Legionella spp.[2]	Levofloxacin or Azithromycin	Moxifloxacin or doxycycline	
Mycoplasma pneumoniae[2]	Doxycycline	Azithromycin, Minocycline	Clindamycin & B-lactams **NOT Effective**. Increasing macrolide resistance.
Mycoplasma hominis	Consult with ID	Consult with ID	**Resistant** to Erythromycin and azithromycin. Fluoroquinolone and Tetracycline resistant strains have been reported. [3]
Stenotrophomonas maltophilia [4]	Consult with ID	Consult with ID	Fluoroquinolone [5] For moderate to severe infectionsID consultation should be considered.
Streptococcus agalactiae (Group B Streptococcus)	Penicillin, Ampicillin, or Amoxicillin	Cefazolin or Vancomycin	
Cutibacterium (Proprionibacterium) acnes[2]	Penicillin, Ceftriaxone	Vancomycin, Daptomycin, Linezolid	Resistant to Metronidazole
Ureaplasma	Azithromycin, Doxycycline		Resistant to Clindamycin. 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.

[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, 2024

Blood Culture Organisms (ALL)	n	% of Total Blood Isolates
Gram-negative, Enterobacerales	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%

Most Common Organism*	n	% of Total Blood Isolates
Escherichia coli, 32% ceftriaxone R	370	22.0%
Staphylococcus aureus, 31% MRSA	239	14.2%
Enterococcus species, 34% VRE	147	8.7%
Klebsiella pneumoniae, 21% ceftriaxone R	136	8.1%
Other Enterobacteriaceae spp.	104	6.2%
Pseudomonas aeruginosa	65	3.9%
Candida glabrata	54	3.2%
Bacteroides species	47	2.8%
Proteus mirabilis	44	2.6%
Enterobacter cloacae complex	41	2.4%
Streptococcus pyogenes	30	1.8%
Klebsiella oxytoca	29	1.7%
Candida albicans	28	1.7%
Streptococcus anginosus group	23	1.4%
Serratia marcescens	22	1.3%
Stenotrophomonas maltophilia	18	1.1%
Candida parapsilosis	18	1.1%
Citrobacter freundii complex	18	1.1%
Klebsiella aerogenes	16	1.0%
Candida auris	14	0.8%
Streptococcus pneumoniae	14	0.8%
Streptococcus agalactiae	14	0.8%
Candida tropicalis	11	0.7%
Total blood isolates *	**1682**	

*Excludes
Coagulase-negative *Staphylococcus* (n= 703)
Viridans group Streptococcus (n=117)
Corynebacterium spp. (n= 63)
Bacillus spp. (n=26)
Micrococcus spp. (n= 33)
Cutibacterium (Propionibacterium) acnes (n=10)
Aerococcus viridans (n=4)

Table 15. Blood: One Isolate per Patient, 2024 (cont.)

Gram-positive Bacterial Isolates*	n	% of Gram-positive Isolates
Staphylococcus aureus, 29% MRSA	208	33%
Enterococcus spp., 30% VRE	176	28%
Viridans group Streptococcus	117	19%
Beta-hemolytic Streptococcus	45	7%
Streptococcus anginosus group	31	5%
Streptococcus pneumoniae	14	2%
Staphylococcus lugdunensis	10	2%
Rothia spp	7	1%
Granulicatella adiacens	6	1%
Arcanobacterium haemolyticum	3	0%
Other Gram-positive	15	2%
Total	632	

*Excludes other coagulase – negative Staphylococcus, *Corynebacterium* spp., *Bacillus* spp., *Micrococcus* spp.

Gram-negative Bacterial Isolates	n	% of Gram-negative Isolates
Escherichia coli, 28% ceftriaxone R	370	43%
Klebsiella spp., 25% ceftriaxone R	171	20%
Other gram-negatives	50	6%
Other *Enterobacteriaceae* spp.	21	2%
Pseudomonas aeruginosa	65	8%
Proteus mirabilis	44	5%
Enterobacter cloacae complex	43	5%
Citrobacter freundii complex	28	3%
Serratia marcescens	22	3%
Stenotrophomonas maltophilia	18	2%
Klebsiella aerogenes	16	2%
Raoultella species	8	1%
Total	856	

Fungal Isolates	n	% of Fungal Isolates
Candida glabrata	54	38%
Candida albicans	28	20%
Candida parapsilosis	18	13%
Candida auris	14	10%
Candida tropicalis	11	8%
Candida guilliermondii	4	3%
Candida lusitaniae	4	3%
Candida krusei	3	2%
Candida dubliniensis	2	1%
Other Fungi	5	3%
Total	**143**	

Anaerobic Bacterial Isolates*	n	% of Anaerobic Bacterial Isolates
Bacteroides species	47	35%
Clostridium spp.	19	14%
Lactobacillus sp	14	10%
Fusobacterium species	11	8%
Anaerobic Gram Negative Rod	6	4%
Anaerobic Gram Positive Rod	4	3%
Prevotella spp.	4	3%
Eggerthella lenta	4	3%
Parvimonas micra	3	2%
Other anaerobe	18	13%
*Excludes Cutibacterium acnes		
Total	**130**	

Mycobacterial Isolates	n	% of Mycobacterial Isolates
Mycobacterium avium	1	17%
Mycobacterium chelonae	1	17%
Mycobacterium cosmeticum	2	33%
Mycobacterium fortuitum group	1	17%
Mycobacterium mucogenicum	1	17%
Total	**6**	

Table 16. CSF: One Isolate per Patient, 2024

CSF Isolates (n = 49)	Number of Isolates
Gram-positive bacteria (18)	9
Coagulase-negative, Staphylococcus	*2*
Staphylococcus aureus	*1*
Micrococcus luteus	*1*
Listeria monocytogenes	*1*
Streptococcus anginosus group	*1*
Coryneform bacteria	*1*
Viridans group Streptococcus	*1*
Enterococcus faecalis	*1*
Enterococcus avium	*9*
Gram-negative bacteria (7)	
Serratia marcescens	2
Acinetobacter baumannii	1
Pseudomonas fluorescens	1
Enterobacter aerogenes (Klebsiella aerogenes)	1
Enterobacter cloacae complex	1
Escherichia coli	1

CSF Isolates (cont.)	Number of Isolates
Anaerobe (13)	
Propionibacterium acnes (Cutibacterium acnes)	12
Actinomyces neuii	1
Fungi (11)	
Cryptococcus neoformans	5
Coccidioides immitis/posadasii	4
Candida dubliniensis	1
Candida glabrata	1

The following antimicrobial agents are <u>not</u> 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, 2024

Organisms	No. of Isolates	# Patients By Source[1]		
		Respiratory	Abscess/ wound/ tissue/other	Blood
Mycobacterium avium complex	305	293	10	2
Mycobacterium mucogenicum	97	95	1	1
Mycobacterium cosmeticum	2	1		1
Mycobacterium chelonae	24	20	3	1
Mycobacterium fortuitum group	11	9	1	1
Mycobacterium simiae	4	4		
Mycobacterium flavescens	2	2		
Mycobacterium lentiflavum	1	1		
Mycobacterium tuberculosis complex	10	10		
Mycobacterium not tuberculosis	4	4		
Mycobacterium abscessus	43	35	8	
Mycobacterium kansasii	4	4		
Mycobacterium xenopi	1	1		
Mycobacterium gordonae	23	23		
Mycobacterium immunogenum	1		1	
Total Mycobacteria	**532**	502	24	6

[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 (*M. chelonae* 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, 2014-2024

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

Antimicrobial Agent	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Isoniazid	9.8%	10.9%	10.9%	7.6% [2]	ND	ND	ND	ND	ND	ND	ND
Rifampin	1.3%	1.4%	1.8%	0.4% [1]	ND	ND	ND	ND	ND	ND	ND
Ethambutol	0.8%	0.7%	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrazinamide	5.5%	5.1%	5.4%	4.5% [1]	ND	ND	ND	ND	ND	ND	ND
Multi-drug Resistant Tuberculosis rates [3]	1.1%	1.3%	1.8%	1.8%	1.2%	1.0%	1.0%	0.6%	0.9%	1.1%	1.0%
MTB Case rate per 100,000 population	5.5	5.5	5.2	5.2	5.3	5.3	4.3	4.4	4.7	5.4	5.4
Number of new cases	2130	2131	2059	2058	2092	2115	1706	1750	1843	2113	2100

[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 2022-2024

Organism	No. Isolates	Amikacin [1]	Ciprofloxacin	Clarithromycin	Trimethoprim-sulfamethoxazole
Mycobacterium abscessus complex [2, 3, 4, 5]	42	81	R	46	R
Mycobacterium fortuitum	11	100	91	10	91
Mycobacterium chelonae	20	95	—	95	—

[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 – 2024) n = 36 *M. abscessus subsp. abscessus* = 72%, *M. abscessus subsp. massiliense* = 38%, *M. abscessus subsp. bolletii* = 0%.

Table 21. CLSI Anaerobic Bacteria Cumulative Antibiogram, % Susceptible

Data derived from CLSI M100S 35th edition[1,2]

***Bacteroides* spp. and *Parabacteroides* spp.**	Ampicillin–Sulbactam		Piperacillin–Tazobactam		Cefoxitin		Ertapenem		Imipenem		Meropenem		Clindamycin		Moxifloxacin		Metronidazole	
	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S
Breakpoints %S		≤8/4		≤16/4		≤16		≤4		≤4		≤4		≤2		≤2		≤8
Bacteroides fragilis	129	84	1030	96	830	100	133	82	189	97	1505	93	1013	26	256	61	1140	100
Bacteroides thetaiotaomicron	76	82	252	87	258	13	—	—	70	100	328	99	328	28	70	54	322	100
Bacteroides ovatus	30	80	206	94	177	20	19[2]	84[2]	49	100	236	95	207	46	59	41	236	100
Bacteroides vulgatus	20[3]	45	168	92	153	73	—	—	35	97	171	96	171	53	29[2]	31	186	100
Bacteroides uniformis	19[2]	84	78	96	72	85	—	—	19[2]	100	93	100	87	45	25[2]	48	89	100
Parabacteroides distasonis	27[2]	59[2]	92	95	82	29	—	—	26[2]	100	119	97	108	43	37	62	118	100

Other Anaerobic Organisms	Ampicillin–Sulbactam		Piperacillin–Tazobactam		Imipenem		Meropenem		Penicillin		Clindamycin		Moxifloxacin		Metronidazole	
	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S	N	%S
Breakpoints %S		≤8/4		≤32/4		≤4		≤4		≤0.5		≤2		≤2		≤8
Prevotella species	29[2]	97[2]	63	100	29	100	92	98	63	100	29[2]	69[2]	92	66	92	99
Fusobacterium species	20[2]	100[2]	55	96	75	95	20[2]	100[2]	—	—	75	77	75	68	75	95
Anaerobic gram-positive cocci [4]	—	—	1853	99	134	99	1647	100	1647	100	1826	97	300	72	1692	100
Cutibacterium (Propionibacterium) acnes	—	—	18[2]	100[2]	17[2]	94[2]	—	—	—	—	17[2]	53[2]	114	95	18[2]	0[2]
Clostridium perfringens	15[2]	100[2]	410	100	23[2]	100	417	100	402	90	425	83	23[2]	83	425	100
Other *Clostridium* species	—	—	439	94	71	99	390	100	390	69	461	67	71	62	461	100

[1] CLSI. Performance Standards for Antimicrobial Susceptibility Testing. 34th ed. CLSI Supplement M100. Clinical and Laboratory Standards Institute; 2023.

[2] Isolates collected from selected US hospitals from January 1st, 2013 to December 31st, 2016.

[3] Calculated from fewer than the standard recommendation of 30 isolates.

[4] Anaerobic gram-positive cocci include *Peptococcus, Peptostreptococcus, Finegoldia, Peptoniphilus, and Anaerococcus* species.

Table 22. Antimicrobials (IV,PO) Formulary Status and Cost Reference

Drug	Usual Dose	Usual Interval	($)*Per Day
Penicillins			
Ampicillin	1 gm	Q6H	24.35
Ampicillin	2 gm	Q6H	27.50
Ampicillin-sulbactam	3 gm	Q6H	30.05
Oxacillin(24-hr infusion)	12 gm	Q24H	54.85
Penicillin G (24-hr infusion)	24 million units	Q24H	27.30
Piperacillin-tazobactam (Extended 4-hr infusion) RTU$^{\Delta}$	4.5 gm	Q8H	36.90
Amoxicillin (PO)	500 mg	Q8H	3.00
Amoxicillin-clavulanic acid (PO)	500 mg	Q8H	4.20
Amoxicillin-clavulanic acid (PO)	875 mg	Q12H	2.50
Cephalosporins			
Cefazolin RTU$^{\Delta}$	1 gm	Q8H	10.65
Cefazolin RTU$^{\Delta}$	2 gm	Q8H	22.55
Cefepime[1,2] RTU$^{\Delta}$	1 gm	Q8H	29.65
Cefepime[1,2] RTU$^{\Delta}$	2 gm	Q8H	45.35
Cefoxitin (peri-operative only)[1,3]	2 gm	once	11.15
Ceftriaxone RTU$^{\Delta}$	1 gm	Q24H	9.55
Ceftriaxone RTU$^{\Delta}$	2 gm	Q24H	18.25
Cephalexin (PO)	500 mg	Q6H	4.70
Cefpodoxime (PO-UTI)	100 mg	Q12H	5.75
Cefpodoxime (PO)	200 mg	Q12H	8.75
Carbapenems/monobactam			
Aztreonam[1,4]	2 gm	Q8H	147.75
Ertapenem[1,5]	1 gm	Q24H	19.90
Meropenem[1,6]	1 gm	Q8H	23.10
Aminoglycosides			
Amikacin[1,7]	1000 mg (15 mg/kg/dose)	Q24H	10.30
Gentamicin	500 mg (7 mg/kg/dose)	Q24H	23.80
Tobramycin[1,8]	500 mg (7 mg/kg/dose)	Q24H	15.70

Table 22. (cont.) Antimicrobials (IV,PO) Formulary Status and Cost Reference

Drug	Usual Dose	Usual Interval	($)*Per Day
Other Antimicrobials (Intravenous)			
Azithromycin[10]	500 mg	Q24H	7.40
Ciprofloxacin[10]	400 mg	Q12H	11.65
Clindamycin[10]	600 mg	Q8H	21.85
Colistimethate[1,9]	150 mg (CBA)**	Q12H	38.90
Daptomycin[1,9]	500 mg	Q24H	20.35
Doxycycline[10]	100 mg	Q12H	27.40
Levofloxacin[10]	750 mg	Q24H	7.75
Linezolid[1, 10,11]	600 mg	Q12H	18.95
Metronidazole[10]	500 mg	Q8H	4.70
Rifampin[1, 10]	600 mg	Q24H	122.10
Tigecycline[1,9]	50 mg	Q12H	44.30
TMP/SMX***[,10]	320 mg TMP	Q12H	34.15
Vancomycin RTU[Δ]	1 gm	Q12H	18.00
Other Antimicrobials (Oral)			
Azithromycin (PO)	500 mg	Q24H	1.75
Ciprofloxacin (PO)	500 mg	Q12H	0.35
Clarithromycin (PO)	500 mg	Q12H	2.35
Clindamycin (PO)	600 mg	Q8H	3.40
Doxycycline (PO)	100 mg	Q12H	2.20
Levofloxacin (PO)	750 mg	Q24H	1.00
Linezolid (PO)[1,11]	600 mg	Q12H	4.15
Metronidazole (PO)	500 mg	Q8H	1.80
Nitrofurantoin (PO) (monohydrate/ macrocrystal formulation)	100 mg	Q12H	4.00
Rifampin (PO)	600 mg	Q24H	1.25
TMP/SMX (PO)	160 mg/800 mg	Q12H	1.00
Vancomycin (PO-cap)	125 mg	Q6H	4.50
Vancomycin (PO-susp)	125 mg	Q6H	1.90

Table 22. (cont.) Antimicrobials (IV,PO) Formulary Status and Cost Reference

Drug	Usual Dose	Usual Interval	($)*Per Day
Antifungal Agents (Intravenous)			
Amphotericin B	50 mg	Q24H	38.45
Amphotericin B Liposomal (AmBisome)[1,9]	400 mg	Q24H	871.80
Micafungin[1]	50 mg	Q24H	22.55
Micafungin[1]	100 mg	Q24H	35.20
Fluconazole	400 mg	Q24H	10.90
Isavuconazonium[1,9]	372 mg	Q24H	361.10
Posaconazole[1,5,10,12]	300 mg	Q24H	105.55
Voriconazole[1,10,13]	300 mg	Q12H	55.28
Antifungal Agents (Oral)			
Fluconazole (PO)	400 mg	Q24H	1.70
Isavuconazonium (PO)[1,9]	372 mg	Q24H	209.00
Posaconazole (PO-DR) [1,5,12]	300 mg	Q24H	50.90
Voriconazole (PO)[1,13]	200 mg	Q12H	21.48

Δ RTU= "Ready to Use" IV bags

* Includes drug acquisition cost plus estimated preparation and administrative costs; charges rounded up to the nearest $0.05

** CBA: Colistin-base activity

***TMP/SMX: Trimethoprim/Sulfamethoxazole

1 Use of Controlled Formulary (CF) antimicrobials is restricted to UCLA Health System-approved criteria.

2 Restricted: suspected or documented *Pseudomonas aeruginosa* infection and in the management of gram-negative meningitis.

3 Restricted: surgical prophylaxis; refer to Pre-incisional Antimicrobial Recommendations.

4 Restricted: aerobic gram-negative infections in patients with documented IgE-mediated hypersensitivity to beta-lactam antibiotics.

5 For Pediatric patients: restricted to use by Pediatric Infectious Diseases Service approval.

6 Restricted: clinical deterioration on concurrent/recent antimicrobials or febrile neutropenia and/or overt sepsis in an immunocompromised patient.

7 Restricted: organisms with suspected/documented resistance to gentamicin and tobramycin.

Restricted: infections caused by organisms with suspected/documented resistance to gentamicin.

Restricted: requires formal consultation by an Infectious Diseases physician; exceptions noted in HS 1444.

Injection: For use in patients unable to tolerate the oral formulations.

Restricted: suspected or documented VRE infection, documented allergy to vancomycin (not Redman's Syndrome).

For prophylaxis of invasive *Aspergillus* and *Candida* infections in severely immunocompromised patients.

8 Restricted: treatment of suspected/documented invasive aspergillosis. For treatment of infections caused by *S. apiospermum*, *Fusarium* species (including *F. solani*) and non-albicans *Candida* species in patients intolerant of, or refractory to other therapy.

Table 23. 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**
   >10^5 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 24. Antimicrobial Agents Routinely Reported – Aerobic Bacteria

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s)[1]
***E. coli, Klebsiella* spp., *P. mirabilis* – 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 (>18 y.o.) Resistant to gentamicin Resistant to piperacillin-tazobactam	 ertapenem (>18 y.o.), imipenem & meropenem (≤18 y.o.) imipenem, meropenem amikacin, tobramycin ertapenem (>18 y.o.), imipenem & meropenem (≤18 y.o.)
***E. coli, Klebsiella* spp., *P. mirabilis* – 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 (>18 y.o.)	 ertapenem (>18 y.o.) & meropenem (≤18 y.o.) meropenem

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

Table 24. Antimicrobial Agents Routinely Reported – Aerobic Bacteria (cont.)

Primary antimicrobials	Conditions for supplemental antimicrobial reporting	Supplemental antimicrobial(s)[3]
Other Enterobacterales organisms[4] – Excludes urine isolates		
amoxicillin/clavulanate		
cefepime	Resistant to cefepime	ertapenem (>18 y.o.), imipenem & meropenem (≤18 y.o.)
	Resistant to ertapenem (>18 y.o.)	imipenem, meropenem
ceftriaxone	Not reported for HECK-Y organisms [5]	
ciprofloxacin (>11 y.o.)		
levofloxacin (>11 y.o.)		
gentamicin	Resistant to gentamicin	amikacin, tobramycin
piperacillin-tazobactam[5]	Resistant to piperacillin-tazobactam	ertapenem (>18 y.o.), imipenem & meropenem (≤18 y.o.)
trimethoprim-sulfamethoxazole		
Other Enterobacterales organisms[3] – Urine isolates		
ampicillin		
amoxicillin/clavulanate		
cefepime	Resistant to cefepime	ertapenem (>18 y.o.) & meropenem (≤18 y.o.)
	Resistant to ertapenem (>18 y.o.)	meropenem
ceftriaxone	Not reported for HECK-Y organisms [5]	
ciprofloxacin (>11 y.o.)		
levofloxacin (>11 y.o.)		
tobramycin		
nitrofurantoin		
trimethoprim-sulfamethoxazole		

[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): azteonam, 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 24. Antimicrobial Agents Routinely Reported – Aerobic Bacteria (cont.)

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

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

[2] Susceptibility performed on stool isolates

Table 24. 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		
Haemophilus influenzae		
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 24. Antimicrobial Agents Routinely Reported – Aerobic Bacteria (cont.)

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

[1] Excluding urine and CSF isolates
[2] Patients >11 y.o.
[3] Excluding CSF isolates

Table 25: CLSI M62 – Expected Antimicrobial Susceptibility Patterns of the Most Commonly Isolated Nocardia Data Derived from CLSI M62[3]

Organism	Amoxicillin/ clavulanic acid	Ceftriaxone	Imipenem	Ciprofloxacin	Minocycline	Linezolid	Trimethoprim – sulfamethoxazole	Amikacin	Tobramycin	Clarithromycin
N. abscessus	S	S	V	R	V	S	S	S	V	R
N. brasiliensis	S	V	R	R	V	S	S	S	S	R
N. cyriacigeorgica	R	S	V	R	V	S	S	S	S	R
N. farcinica	S	R	V	V	V	S	S	S	R	R
N. nova complex [1]	R	V	S	R	V	S	S	S	R	S
N. otitdiscaviarum	R	R	R	V	V	S	S	S	S	V
N. pseudobrasiliensis	R	R	R	S	R	S	V	S	S	S
N. transvalensis complex [2]	V	S	V	S	V	S	S	R	R	R

[1] N. nova complex includes N. africana, N. elegans, N., kruczakiae, N. nova, and N. veterana
[2] N. transvalensis complex include N. blacklockiae, N. transvalnesis, and N. wallacei
[3] Adapted from CLSI M62 2nd edition, February 2023

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

	Penicillins			Cephalosporins					Carbapenems			Amino-glycosides			Fluoro-quinolones		Other							
	Ampicillin	Ampicillin-sulbactam	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
Enterobacterales	≤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																								
Acinetobacter species	R	≤8	≤16	R	≤8	≤8	≤8	≤8	R	≤2	≤2	≤16	≤4	≤4	≤1	≤2	≤2	≤2/38	–	≤1	–	–	–	–
Pseudomonas aeruginosa	R	R	≤16	R	≤8	R	≤8	R	R	≤2	≤2	≤16[5]	–	≤1	≤0.5	≤1	≤2	R	–	–	R	≤4/4	≤8/4	–
Stenotrophomonas maltophilia	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 35th 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] Amikacin breakpoints for Pseudomonas aeruginosa for Urine sources only.

Table 27. 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-dalfopristin	Rifampin	Trimethoprim – sulfamethoxazole	Vancomycin
Staphylococcus aureus [2] *Staphylococcus lugdunensis*	—	≤2	≤0.12	≤1	≤4	—	≤1	≤0.5	≤1	≤4	≤0.5	≤4	≤32	≤1	≤1	≤2/38	≤2
Coagulase-negative *Staphylococcus*	—	≤0.5	≤0.12 [3]	—	≤4	—	≤1	≤0.5	≤1	≤4	≤0.5	≤4	≤32	≤1	≤1	≤2/38	≤4
Enterococcus spp. Enterococcus faecalis	≤8	—	≤8	R	R	≤500	≤1	R	≤2	≤4	R	≤2	≤32	≤1	≤1	R	≤4
Enterococcus faecium	≤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
Streptococcus pneumoniae	—	—	—	—	≤0.25	≤1	—	≤2	≤1
Meningitis	—	≤0.06	≤0.5	≤0.5	—	—	—	—	—
Non-meningitis	≤2	≤2	≤1	≤1	—	—	≤0.25	—	—
Viridans group *Streptococcus*	—	≤0.12	≤1	≤1	—	—	—	—	≤1

[1] Data derived from CLSI M100 35th edition.
[2] S. aureus only, including MRSA
[3] beta-lactamase negative

Table 28. 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/